**IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION**

UNILOC 2017 LLC, and UNILOC LICENSING USA LLC.,	§ § § § §	Case No. 2:18-cv-00380
Plaintiffs,	§ § §	Jury Trial Demanded
v.	§ § §	
VERIZON COMMUNICATIONS INC., CELLCO PARTNERSHIP INC. D/B/A VERIZON WIRELESS, VERIZON BUSINESS NETWORK SERVICES, INC., and VERIZON DIGITAL MEDIA SERVICES, INC.,	§ § § § § § § §	
Defendants.	§ § § §	

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiffs Uniloc 2017 LLC and Uniloc Licensing USA LLC (collectively "Uniloc"), by and through the undersigned counsel, hereby file this Complaint and make the following allegations of patent infringement relating to U.S. Patent Nos. 7,075,917, 6,664,891, 6,519,005 and 7,016,676 against Defendants Verizon Communications, Inc., Cellco Partnership Inc. d/b/a Verizon Wireless, Verizon Business Network Services, Inc., and Verizon Digital Media Services, Inc. (collectively "Verizon") and allege as follows upon actual knowledge with respect to themselves and their own acts and upon information and belief as to all other matters:

NATURE OF THE ACTION

1.   This is an action for patent infringement. Uniloc alleges that Verizon infringes U.S. Patent Nos. 7,075,917 (the "'917 patent"), 6,664,891 (the "'891 patent"), 6,519,005 (the "'005 patent"), and 7,016,676 (the "'676 patent") copies of which are attached hereto as Exhibits A-D (collectively, "the Asserted Patents").

2.   Uniloc alleges that Verizon directly and indirectly infringes the Asserted Patents by making, using, offering for sale, selling and importing: (1) hotspots, modems and terminals that operate in compliance with HSUPA/HSUPA+ standardized in UMTS 3 GPP Release 6 and above, such as the JetPack 4G LTE Mobile Access Hotspot AC791L ("Verizon Jetpack 4G LTE"), and the Verizon Global Modem USB730L ("Verizon Global Modem"), the Verizon Jetpack MiFi 7730L ("Verizon Jetpack MiFi"), (2) message broadcasting systems in retail stores and a related mobile application used by customers in receiving beacons, such as Verizon BLE Beacons, (3) services that provide a method for motion coding an uncompressed digital video data stream such as Verizon's Uplynk Video Streaming and FiOS services and related encoders and (4) Verizon's network, base stations, and controllers that provide shared network access to LTE-LAA and Wi-Fi capable devices over at least one common frequency band. Uniloc further alleges that Verizon induces and contributes to the infringement of others. Uniloc seeks damages and other relief for Verizon's infringement of the Asserted Patents.

1

THE PARTIES

3.   Uniloc 2017 LLC is a Delaware corporation having places of business at 1209 Orange Street, Wilmington, Delaware 19801, 620 Newport Center Drive, Newport Beach, California 92660 and 102 N. College Avenue, Suite 303, Tyler, TX 75702.

4.   Uniloc Licensing USA LLC is a Delaware corporation having places of business at 1209 Orange Street, Wilmington, Delaware 19801, 620 Newport Center Drive, Newport Beach, California 92660 and 102 N. College Avenue, Suite 303, Tyler, TX 75702.

5.   Uniloc holds all substantial rights, title and interest in and to the Asserted Patents.

6.   Upon information and belief, Defendant Verizon Communications Inc. is a Delaware corporation with a place of business in New York, New York. Verizon Communications Inc. can be served with process by serving its registered agent for service of process in Texas at CT Corporation System, 1999 Bryan St., Suite 900, Dallas, Texas 75201.

7.   Upon information and belief, Defendant Cellco Partnership Inc. d/b/a/ Verizon Wireless is a Delaware general partnership with a place of business in Basking Ridge, New Jersey. Cellco Partnership Inc. d/b/a Verizon Wireless can be served with process by serving its registered agent for service of process in Texas at CT Corporation System, 1999 Bryan St., Suite 900, Dallas, Texas 75201.

8.   Upon information and belief, Defendant Verizon Business Network Services, Inc. is a Delaware corporation with a place of business in Richardson, Texas. Verizon Business Network Services, Inc. can be served with process by serving its registered agent for service of process in Texas at CT Corporation System, 1999 Bryan St., Suite 900, Dallas, Texas 75201.

9.   Upon information and belief, Defendant Verizon Digital Media Services, Inc. is a California corporation with a place of business in Los Angeles, California. Verizon Digital Media Services, Inc. can be served with process by serving its registered agent for service of process in Texas at CT Corporation System, 1999 Bryan St., Suite 900, Dallas, Texas 75201.

10.   Verizon's website identifies at least the following locations for Verizon retail stores in this District: 2035 North Central Expressway, Suite 620, McKinney, Texas; 8988 South Broadway Avenue, Suite 110, Tyler, Texas and 2330 Preston Road, Suite 500, Frisco, Texas.

11.   Upon information and belief, Verizon has invested more than $1 billion in plant and equipment and owns or manages hundreds of buildings and locations in Texas.

12.   Upon information and belief, Verizon has more than 10,000 employees in Texas.

JURISDICTION AND VENUE

13.   This action for patent infringement arises under the Patent Laws of the United States, 35 U.S.C. § 1 et. seq. This Court has original jurisdiction under 28 U.S.C. §§ 1331 and 1338.

14.   This Court has both general and specific jurisdiction over Verizon because Verizon has committed acts within the Eastern District of Texas giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over Verizon would not offend traditional notions of fair play and substantial justice. Defendant Verizon, directly and through subsidiaries, intermediaries (including distributors, retailers, franchisees and others), has committed and continues to commit acts of patent infringement in this District, by, among other things, making, using, testing, selling, licensing, importing and/or offering for sale/license products and services that infringe the Asserted Patents.

15.   Venue is proper in this district and division under 28 U.S.C. §§ 1391(b)-(d) and 1400(b) because Verizon has committed acts of infringement in the Eastern District of Texas and has multiple regular and established places of business in the Eastern District of Texas.

COUNT I – INFRINGEMENT OF U.S. PATENT NO. 7,075,917

16.   The allegations of paragraphs 1-15 of this Complaint are incorporated by reference as though fully set forth herein.

17.   The '917 patent, titled "Wireless Network With A Data Exchange According to the ARQ

3

Method," issued on July 11, 2006. A copy of the '917 patent is attached as Exhibit A.

18.   Pursuant to 35 U.S.C. § 282, the '917 patent is presumed valid.

19.   Invented by Koninklijke Philips Electronics, N.V., the inventions of the '917 patent were not well-understood, routine or conventional at the time of the invention. At the time of invention of the '917 patent, wireless communications systems that implemented a hybrid Automatic Repeat Request (ARQ) suffered from drawbacks. '917 patent at 1:10-67. According to hybrid ARQ methods, data sent in Packet Data Units (PDU) by the Radio Link Control layer (RLC layer) additionally provided for the error correcting coding with an error control through repetition of transmission. *Id.* at 1:18-21. This means that in the case of an error-affected reception of a packet data unit packed in a transport block coded by one of the assigned physical layers, a received packet data unit affected by error is sent anew. *Id*. at 1:21-25. In certain hybrid ARQ methods (e.g., types II and III), the affected packet data unit will be buffered over long time spaces until an incremental redundancy is requested and then, after a successful decoding, the reception may be acknowledged as correct, especially when the receiving side is the network side, while the physical layer and the RLC layer are usually located on different hardware components. *Id.* at 1:44-50. At the time of the invention, it was desirable to reduce these periods of time that the error-affected data would be buffered to improve overall communication rates in the network. *Id.* at 1:64-67.

20.   The inventive solution of the claimed inventions of the '917 patent provides a radio network controller and a terminal in a wireless network that exchange data according to a hybrid ARQ method. The specific radio terminals and controller of the '917 invention overcome one or more problems of the prior art. *Id.* at 2:1-24. The wireless network components of the '917 patent transmit an acknowledge command over a back channel (previously unknown) between a physical layer of a transmitting side (for example, a radio network controller) and the physical layer of a receiving side (for example, a terminal), which allows a correct or error-affected transmission of a transport block to be

announced to the transmitting side much more rapidly than prior art systems. *Id*. at 2:28-36. As a result, a repetition of transmission with incremental redundancy may be performed rapidly. *Id*. at 2:36-38. This enables the receiving side to buffer the received coded transport block affected by error more briefly because the additional redundancy necessary for the correct decoding is available at an earlier instant. *Id*. at 2:39-42. In this manner, the memory capacity or memory area needed on average for buffering blocks affected by error is also reduced. *Id*. at 2:42-44.

21.   A person of ordinary skill in the art reading the '917 patent and its claims would understand that the patent's disclosure and claims are drawn to solving a specific, technical problem arising in radio communication systems using a hybrid ARQ data transmission method. Moreover, a person of ordinary skill in the art would understand that the claimed subject matter of the '917 patent presents advancements in the field of wireless networking and, more particularly, wireless networks implementing hybrid ARQ data transmission methods. Indeed, the time of invention was less than two months after the release of the document entitled, "3rd Generation Partnership Project, Technical Specification Group Radio Access Network, Report on Hybrid ARQ Type II/III (Release 2000), 3G TR 25.835 V0.0.2, TSG-RAN Working Group 2 (Radio L2 and Radio L3), Sophia Antipolis, France, 21–15 August 2000," which described the specific types of hybrid ARQ network on which the invention improves. And, as detailed by the specification, the prior hybrid ARQ data transmission methods suffered drawbacks such that a new and novel method was required. The inventions of the '917 patent are also indigenous to the then nascent field of wireless networks implementing hybrid ARQ data transmission methods.

22.   In light of the foregoing, a person of ordinary skill in the art would understand that claim 10 of the '917 patent is directed to a specific improvement on wireless networks implementing hybrid ARQ data transmission methods.

23.   On information and belief, Verizon makes, uses, offers for sale, and sells in the United

States and imports into the United States hotspots, modems and terminals that operate in compliance with HSUPA/HSUPA+ standardized in UMTS 3 GPP Release 6 and above, such as the JetPack 4G LTE Mobile Access Hotspot AC791L ("Verizon Jetpack 4G LTE"), the Verizon Global Modem USB730L ("Verizon Global Modem"), the Verizon Jetpack MiFi 7730L ("Verizon Jetpack MiFi") (collectively the "Accused Infringing Devices").

24.   Upon information and belief, the Accused Infringing Devices infringe at least claim 10 of the '917 patent in the exemplary manner described below.

25.   The Accused Infringing Devices are operable in a WCDMA network having a radio network controller and other user equipment (other UEs or further terminals). The Accused Infringing Devices have a physical layer for the transmission and reception of data.   Section 6 shows that the UMTS terrestrial radio access network (UTRAN) includes a radio network controller.
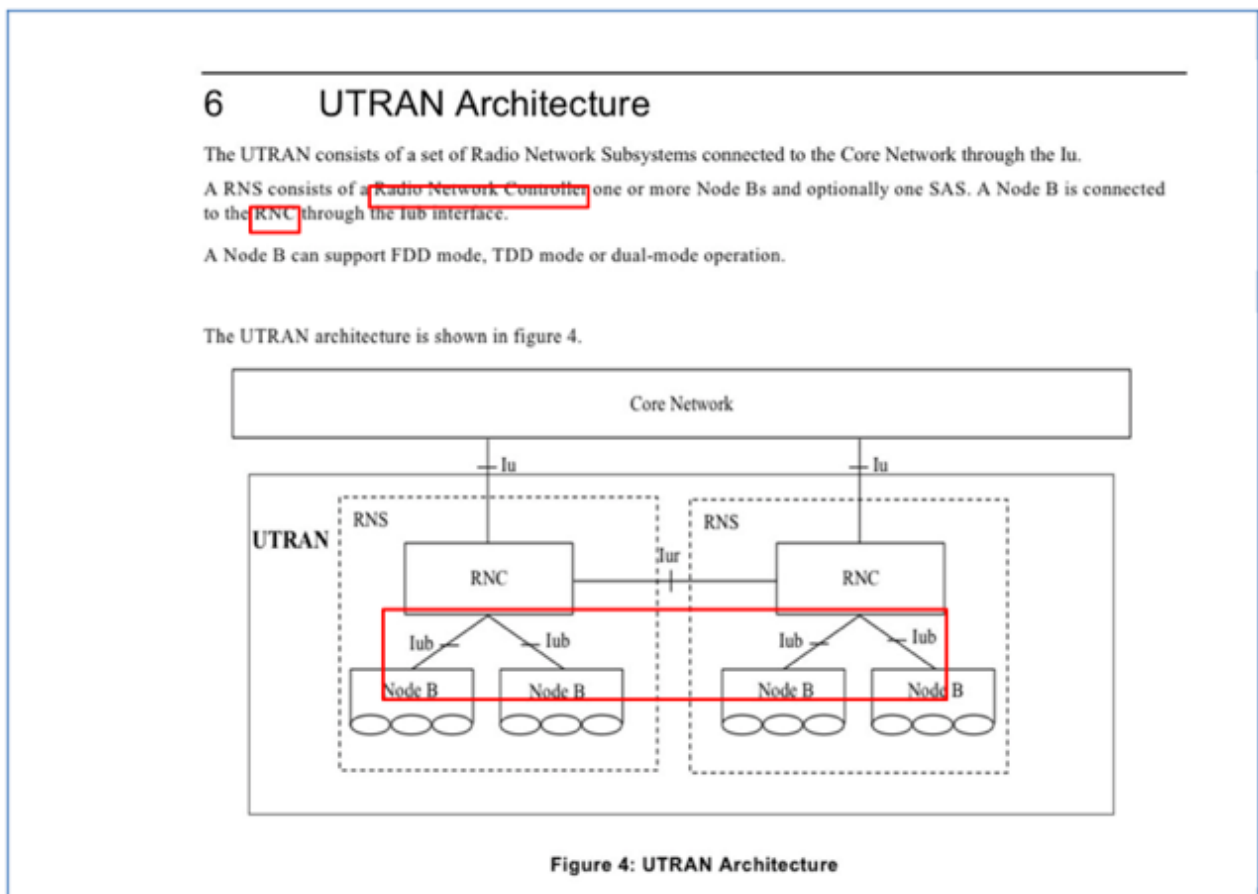
Source: (3GPP TS 25.401 V6.9.0 (2006-12), pages 13-14)

26.   The Accused Infringing Devices support WCDMA/HSUPA functionality.

Verizon Jetpack®
4G LTE Mobile
Hotspot – AC791L
$99.99

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Device Specifications

LTE Advanced	With 50% faster peak speeds in more than 450 cities from coast to coast.
World Device	Works in over 200 countries depending on your plan.
Usage Time - Up to:	24 hrs
Standby Time - Up to:	27 days
Weight	5.8 oz
Height	4.33 in
Width	2.67 in
Depth	0.75 in
Size	4.33" (H) x 2.67" (W) x 0.75" (D)
SAR	1.24 W/kg
Network	Network Modes: CDMA 1xEVDO Rev. A (800/1900Mhz) GSM/EDGE (850/900/1800/1900Mhz) UMTS/HSPA (850/900/1900/2100Mhz); LTE Bands: 13/4 (700/1700 MHz)
Battery	4,340 mAh
System Requirements	Microsoft Windows 8, Windows 7 SP1, Windows Vista SP2, Windows XP SP3 or higher, MAC and other operating systems
Screen	1.77" TFT Display (128x160) with touch navigation buttons

Source: https://www.verizonwireless.com/internet-devices/verizon-jetpack-4g-lte-mobile-hotspot-ac791l/

27.   Figure 1 shows that the Accused Infringing Devices are part of a network and that the

Accused Infringing Devices have a physical layer/ L1.

7

4   Assumed UMTS Architecture

Figure 1 shows the assumed UMTS architecture as outlined in [1]. The figure shows the UMTS architecture in terms of its entities User Equipment (UE), UTRAN and Core Network. The respective reference points Uu (Radio Interface) and Iu (CN-UTRAN interface) are shown. The figure illustrates furthermore the high-level functional grouping into the Access Stratum and the Non-Access Stratum.
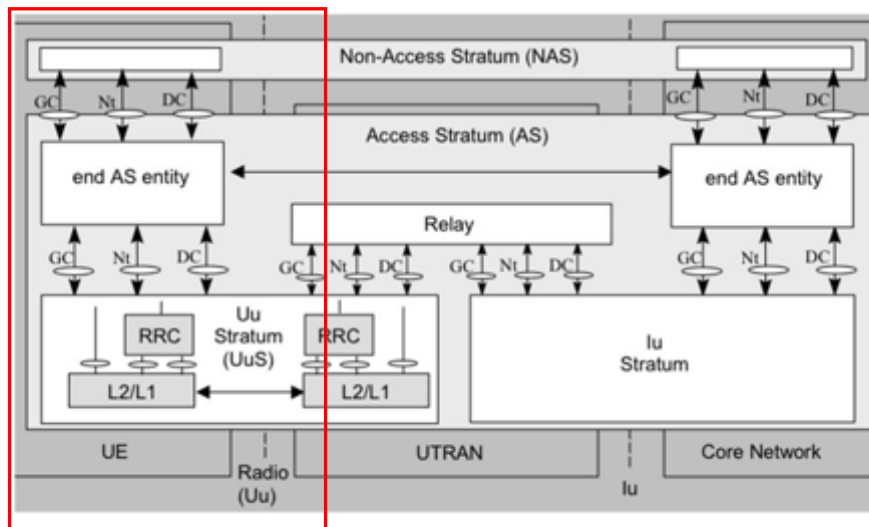
Figure 1: Assumed UMTS Architecture

Source: 3GPP TS 25.301 V6.6.0 (2008-03), pages 8-9

28.   Section 5.1 shows that the radio interface in the Accused Infringing Devices has a physical layer.

8

5.1 Overall protocol structure

The radio interface is layered into three protocol layers:

- the physical layer (L1);
- the data link layer (L2);
- network layer (L3).

Layer 2 is split into following sublayers: Medium Access Control (MAC), Radio Link Control (RLC), Packet Data Convergence Protocol (PDCP) and Broadcast/Multicast Control (BMC).
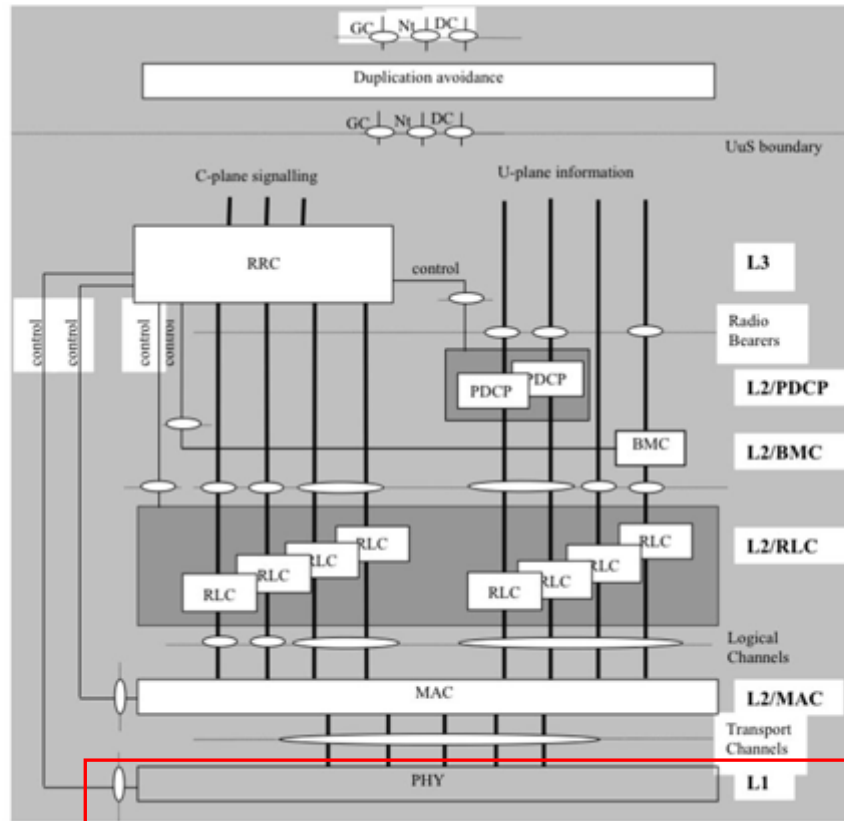

Figure 2: Radio Interface protocol architecture (Service Access Points marked by circles)

Source: (3GPP TS 25.301 V6.6.0 (2008-03), pages 9-11)

29.   The Accused Infringing Devices store in a physical layer buffer ("stored in memory") medium access control-es (MAC-es) protocol data units (PDUs) ("transport blocks") after being hybrid automatic repeat request (HARQ) coded ("coded transport blocks"). Each MAC-es PDU ("transport block") includes at least one acknowledged mode data radio (AMD) radio link control (RLC) PDU ("a packet data unit which is delivered by an assigned radio link control layer"). Each AMD RLC PDU has a unique 12-bit sequence number ("identified by a packet data unit sequence number"). Section 4.8 shows that the enhanced uplink data is HARQ codes in the physical layer for transmission.

9

4.8   Coding for E-DCH

Figure 21 shows the processing structure for the E-DCH transport channel mapped onto a separate CCTrCH. Data arrives to the coding unit in form of a maximum of one transport block once every transmission time interval (TTI). The following coding steps can be identified:

- Add CRC to the transport block

- Code block segmentation

- Channel coding

- Physical layer hybrid ARQ and rate matching

- Physical channel segmentation

- Interleaving

- Physical channel mapping

The UTRAN architecture is shown in figure 4.

The coding steps for E-DCH transport channel are shown in the figure below.
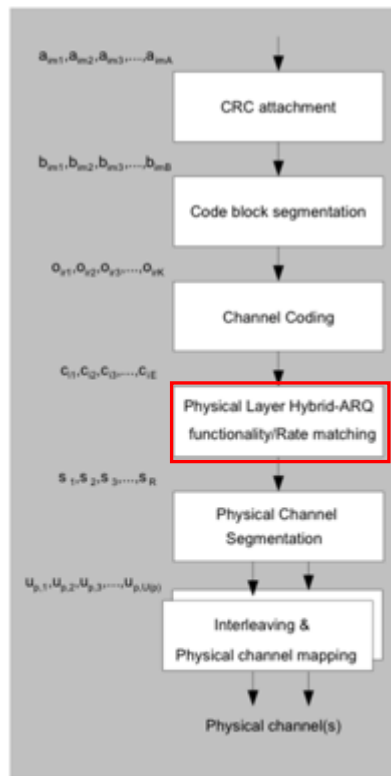
CRC attachment

Code block segmentation

Channel Coding

Physical Layer Hybrid-ARQ functionality/Rate matching

Physical Channel Segmentation

Interleaving & Physical channel mapping

Physical channel(s)

Figure 21: Transport channel processing for E-DCH

Source: 3GPP TS 25.212 V6.10.0 (2006-12), pages 65-66

30.   Section 4.2.1.3.1 shows that the AMD RLC PDUs ("a packet data unit which is delivered by an assigned radio link control layer") are provided to lower layers, such as the MAC layer.

4.2.1.3.1   Transmitting side

The transmitting side of the AM-RLC entity receives RLC SDUs from upper layers through the AM-SAP.

RLC SDUs are segmented and/or concatenated into AMD PDUs of a fixed length. The segmentation is performed if the received RLC SDU is larger than the length of available space in the AMD PDU. The uplink AMD PDU size is a semi-static value that is configured by upper layers and can only be changed through re-establishment of the AM RLC entity by upper layers.

The transmitting side of the AM RLC entity submits AMD PDUs to the lower layer through either one or two DCCH or DTCH logical channels.

Source: 3GPP TS 25.322 V6.12.0 (2008-05), pages 16-17

31.   Figure 9b of section 5.3.5 shows that at least one RLC PDU ("packet data unit") is encapsulated into a MAC-es PDU ("transport block"), which is provided to the physical layer, such as HARQ coding.

5.3.5   Data flows through Layer 2

Data flows through layer 2 are characterised by the applied data transfer modes on RLC (acknowledged, unacknowledged and transparent transmission) in combination with the data transfer type on MAC, i.e. whether or not a MAC header is required. The case where no MAC header is required is referred to as "transparent" MAC transmission. Acknowledged and unacknowledged RLC transmissions both require a RLC header. In unacknowledged transmission, only one type of unacknowledged data PDU is exchanged between peer RLC entities. In acknowledged transmission, both (acknowledged) data PDUs and control PDUs are exchanged between peer RLC entities.

The resulting different data flow cases are illustrated in Figures 6 - 9. On the level of detail presented here, differences between acknowledged and unacknowledged RLC transmission are not visible. Acknowledged and unacknowledged RLC transmission is shown as one case, referred to as non-transparent RLC.
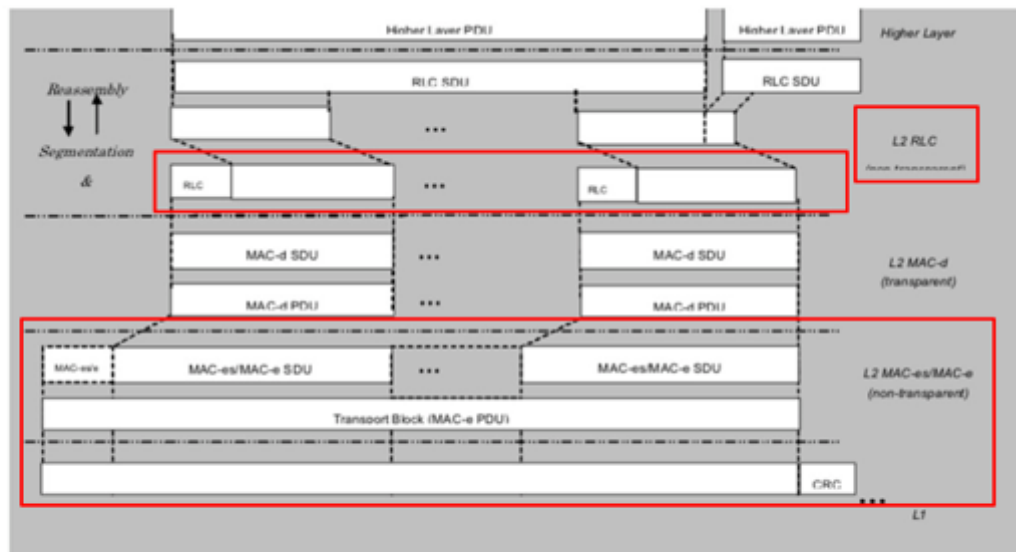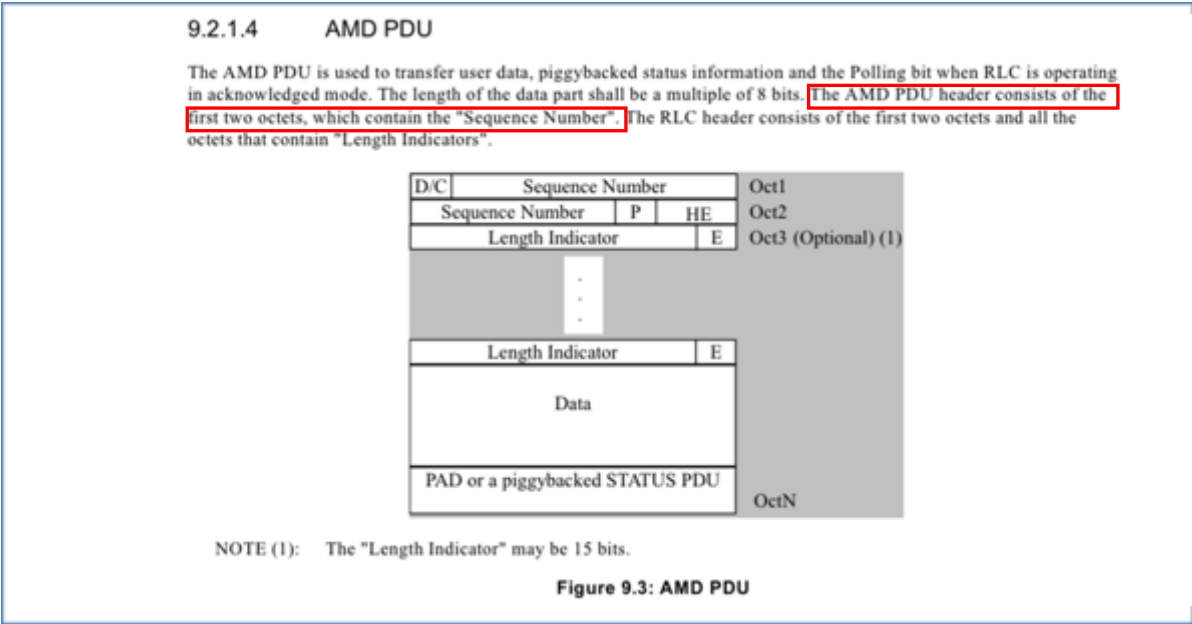

Figure 9b: Data flow for non-transparent RLC and MAC mapped to E-DCH

Source: 3GPP TS 25.301 V6.6.0 (2008-03), pages 21, 25

11

32.   Sections 9.2.1.4 and 9.2.2.3 show that the AMD PDUs have a sequence number.

Source: 3GPP TS 25.322 V6.12.0 (2008-05), pages 26-27

Source: 3GPP TS 25.322 V6.12.0 (2008-05), pages 28-29

33.   Section 11.3.4.8 shows that the sequence number in the AMD PDUs are used for duplicate

detection and are uniquely identified by the sequence number within the receiving window.


Source: 3GPP TS 25.322 V6.12.0 (2008-05), page 71

34.   Each MAC-es PDU ("coded transport blocks") has a transmission sequence number, TSN,

("abbreviated sequence number") and the MAC-es PDU with its TSN ("abbreviated sequence number")

is stored at least within a HARQ entity of the Accused Infringing Devices for potential HARQ retransmission. The TSN is 6 bits ("length"), which is shorter ("abbreviated") than the AM RLC PDU sequence number of 12 bits. The MAC-es PDUs, including the TSNs, are transmitted to the serving radio network controller (SRNC) via the NodeB/base station ("transmitted to the radio network controller").

35.   The TSN length depends on the maximum number of MAC-es PDUs to be stored unambiguously within a reordering buffer at the SRNC. The SRNC performs duplicate detection on the received MAC-es PDUs by using the TSN. If two different MAC-es PDUs (not a duplicate) had the same TSN, the SRNC would erroneously discard a correctly received MAC-es PDU. Thus, the TSN must be uniquely associated with each MAC-es PDU (non-duplicate) in the reordering buffer ("which can be shown unambiguously in a packet data sequence number"). To achieve this unique association, the TSN length must accommodate the maximum number of MAC-es PDUs that can be stored in the reordering buffer. The TSN length is 6 bits, which has values from 0 to 63 ("whose length depends on the maximum number of coded transport blocks to be stored.")

36.   Section 9.2.4.1 shows that the length of the TSN is 6 bits (which is shorter than the 12-bit AMD PDU sequence number.)
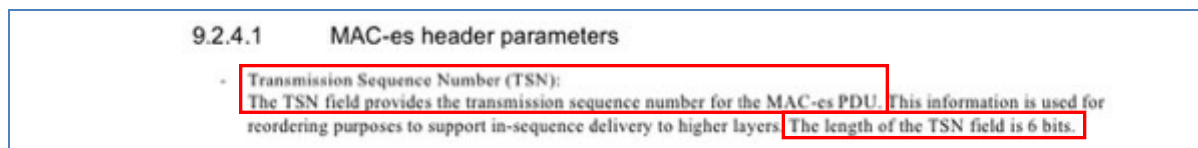
Source: 3GPP TS 25.321 V6.18.0 (2009-03), page 50

37.   Section 11.8.1.2.1 shows that each MAC-es PDU is sequentially assigned an incremented sequence number so that each MAC-es PDU will have a unique sequence number in the SRNC reordering buffer.

> **11.8.1.2.1   TSN setting process operation**
>
> There is one TSN setting process at the UE for each logical channel. When a MAC-es PDU is transmitted, the UE operation in support of the re-ordering functionality consists in generating an explicit sequence number (TSN) for the MAC-es PDU intended for the associated re-ordering queue. In one TTI, there is only one TSN per logical channel: one for the MAC-es PDU that is transmitted.
>
> Each TSN setting process maintains the state variable CURRENT_TSN, which indicates the sequence number to be included in the header of the following MAC-es PDU to be generated. When the TSN setting process is established, CURRENT_TSN shall be initialized to 0.
>
> When a new payload needs to be generated for the associated re-ordering queue, the Multiplexing and TSN setting entity shall:
>
> - set the TSN of the transmission to CURRENT_TSN;
>
> After each MAC-es PDU is multiplexed:
>
> - increment CURRENT_TSN by 1;
>
> - if CURRENT_TSN > 63:
>
>   - set CURRENT_TSN = 0.

Source: 3GPP TS 25.321 V6.18.0 (2009-03), pages 74-75

38.   Figure 9.1.5.1 of section 9.1.5 shows that the MAC-es PDU has a TSN.

> **9.1.5   MAC PDU (E-DCH)**
>
> In the case of E-DCH there are two MAC sublayers, MAC-e and MAC-es. MAC-es sits on top of MAC-e and receives PDUs directly from MAC-d. MAC-es SDUs (i.e. MAC-d PDUs) of the same size, coming from a particular logical channel are multiplexed together into a single MAC-es payload. There is one and only one MAC-es PDU per logical channel per TTI (since only one MAC-d PDU size is allowed per logical channel per TTI). To this payload is prepended the MAC-es header (see subclause 9.2.4.1). The number of PDUs, as well as the one DDI value identifying the logical channel, the MAC-d flow and the MAC-es SDU size are included as part of the MAC-e header. In case sufficient space is left in the E-DCH transport block or if Scheduling Information needs to be transmitted, an SI will be included at the end of the MAC-e PDU (see subclause 9.2.4.2). Multiple MAC-es PDUs from multiple logical channels, but only one MAC-e PDU can be transmitted in a TTI.
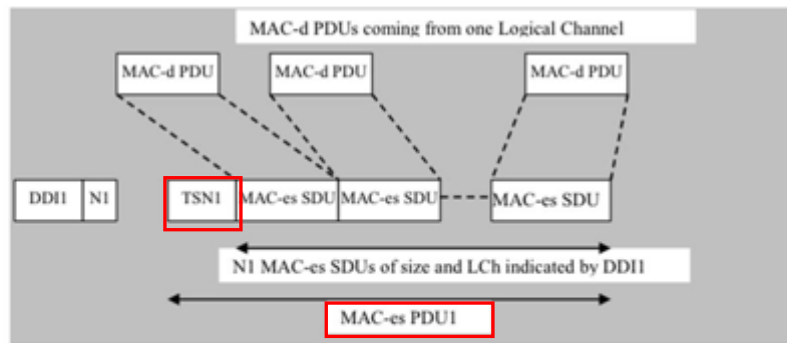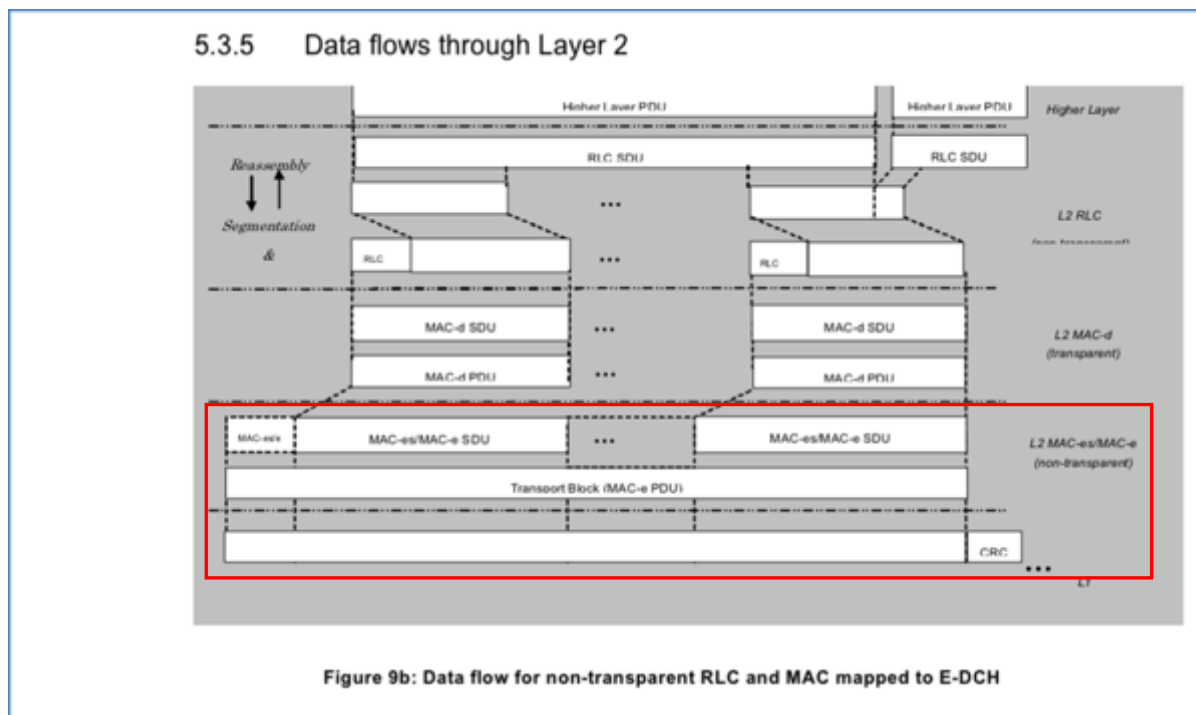

Figure 9.1.5.1 MAC-es PDU

Source: 3GPP TS 25.321 V6.18.0 (2009-03), page 35

39.   Section 5.3.5 shows that the MAC-es PDU is provided to the physical layer for transmission (including HARQ coding).

14

Figure 9b: Data flow for non-transparent RLC and MAC mapped to E-DCH

Source: 3GPP TS 25.301 V6.6.0 (2008-03), pages 21, 25

40.   Sections 11.8.3.1 from TS 25.321 and 10.3.2.2 from 3G Evolution HSPA and LTE for

Mobile Broadband show that the infrastructure stores MAC-es PDUs in a reodering buffer and uses their

unique TSNs to reorder and detect duplicate MAC-es PDUs within the reordering buffer.
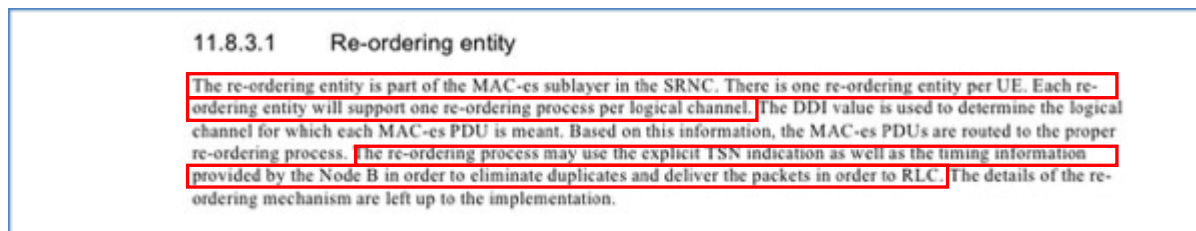
Source: 3GPP TS 25.321 V6.18.0 (2009-03), page 83

15

10.3.2.2. In-Sequence Delivery

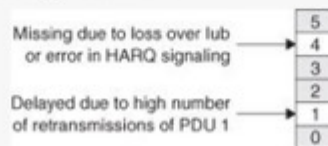Similar to the case for HS-DSCH, the multiple hybrid ARQ processes of E-DCH cannot, in themselves, ensure in-sequence delivery, as there is no interaction between the processes. Also, in soft handover situations, data is received independently in several NodeBs and can therefore be received in the RNC in a different order than transmitted. In addition, differences in Iub/Iur transport delay can cause out-of sequence delivery to RLC. Hence, in-sequence delivery must be implemented on top of the MAC-e entity and a reordering entity in the RNC has been defined for this purpose in a separate MAC entity, the MAC-es. In E-DCH, the reordering is always performed per logical channel such that all data for a logical channel is delivered in-sequence to the corresponding RLC entity. This can be compared to HS-DSCH where the reordering is performed in configurable reordering queues.

The actual mechanism to perform reordering in the RNC is implementation specific and not standardized, but typically similar principles as specified for the HS-DSCH are used. Therefore, each MAC-es PDU transmitted from the UE includes a *Transmission Sequence Number* (TSN), which is incremented for each transmission on a logical channel. By ordering the MAC-es PDUs based on TSN, in-sequence delivery to the RLC entities is possible.

To illustrate the reordering mechanism consider the situation shown in Figure 10.25. The MAC-es PDUs 0, 2, 3, and 5 have been received in the RNC while MAC-es PDUs 1 and 4 have not yet been received. The RNC can in this situation not know why PDUs 1 and 4 are missing and needs to store PDUs 2, 3, and 5 in the reordering buffer. As soon as PDU 1 arrives, PDU 1, 2, and 3 can be delivered to RLC.

Figure 10.25. Reordering mechanism.

Missing due to loss over Iub or error in HARQ signaling → 5, 4, 3

Delayed due to high number of retransmissions of PDU 1 → 2, 1, 0

Source: 3G Evolution HSPA and LTE for Mobile Broadband, §10.3.2.2

41.   The physical layer of the Accused Infringing Devices receives a HARQ coded MAC-hs PDU ("coded transport block") over high speed physical downlink shared channel(s), HS-PDSCH(s). As described in the '917 patent, the radio network controller sends downlink data using its base station ("radio network controller"). The Accused Infringing Devices check the transport block for errors in reception. In response to the error check, the Accused Infringing Devices send an ACK ("acknowledge command") or a NACK ("negative acknowledge command") over the high speed physical dedicated control channel, HS-PDCCH ("back channel").

42.   Section 5.2.1.2 shows that the HS-PDCCH ("back channel") sends HARQ-ACK

("acknowledge command" or "negative acknowledge command").
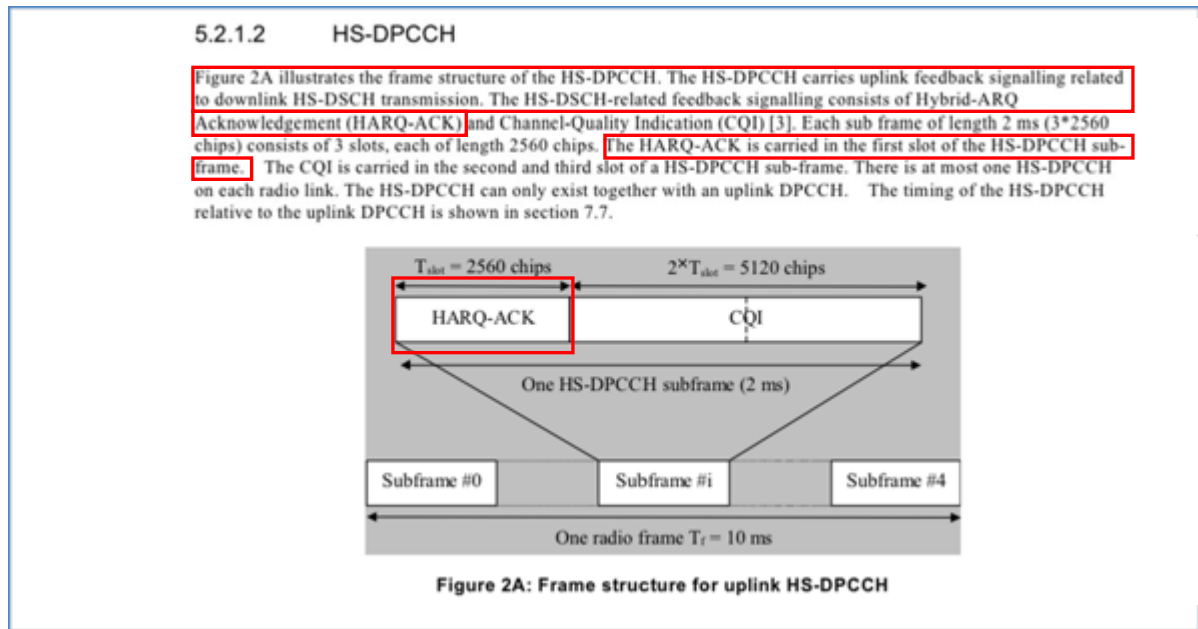
Source: 3GPP TS 25.211 V6.10.0 (2009-09), pages 12-13

43.   Sections 6A.1.1 and 4.2.3.3 show that the Accused Infringing Devices transmit the

ACKs/NACKs in response to received MAC-hs PDUs from the MAC-hs HARQ entity.
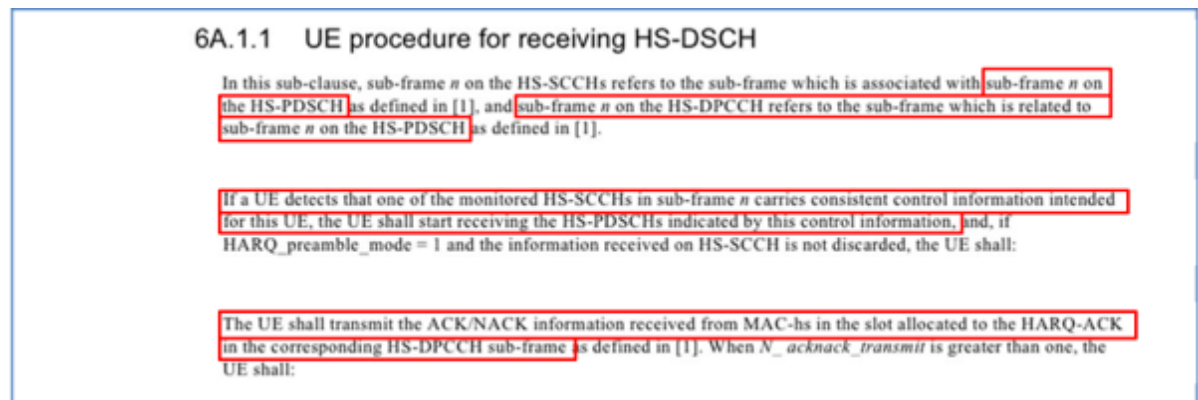
Source: 3GPP TS 25.214 V6.11.0 (2006-12), pages 34-35

4.2.3.3   MAC-hs entity – UE Side

The MAC-hs handles the HSDPA specific functions. In the model below the MAC-hs comprises the following entities:

- HARQ:
  The HARQ entity is responsible for handling the MAC functions relating to the HARQ protocol. The HARQ functional entity handles all the tasks that are required for hybrid ARQ. It is responsible for generating ACKs or NACKs. The detailed configuration of the hybrid ARQ protocol is provided by RRC over the MAC-Control SAP.

The associated signalling shown in the figure illustrates the exchange of information between layer 1 and layer 2 provided by primitives shown in [3].
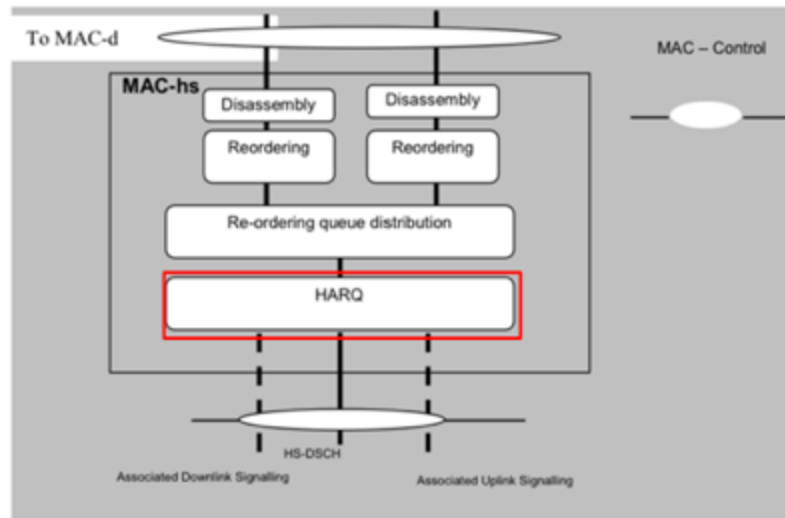
Figure 4.2.3.3.1: UE side MAC architecture / MAC-hs details

Source: 3GPP TS 25.321 V6.18.0 (2009-03), pages 16-17

44.   Section 11.6.2.2 shows that the Accused Infringing Devices send an ACK when no error is detected ("correct reception") or a NACK when an error is detected ("there is error-affected reception").

11.6.2.2   HARQ process

The HARQ process processes the New Data Indicator indicated by lower layers for each received MAC-hs PDU.

The UE shall:

- if the data in the soft buffer has been successfully decoded and no error was detected:
  - deliver the decoded MAC-hs PDU to the reordering entity;
  - generate a positive acknowledgement (ACK) of the data in this HARQ process.
- else:
  - generate a negative acknowledgement (NAK) of the data in this HARQ process;
- schedule the generated positive or negative acknowledgement for transmission and the time of transmission relative to the reception of data in a HARQ process is configured by upper layer.

18

Source: 3GPP TS 25.321 V6.18.0 (2009-03), pages 68-69

45.   Verizon has infringed, and continues to infringe, at least claim 10 of the '917 patent in the United States, by making, using, offering for sale, selling and/or importing the Accused Infringing Devices in violation of 35 U.S.C. § 271(a).

46.   Verizon also has infringed, and continues to infringe, at least claim 10 of the '917 patent by actively inducing others to use, offer for sale, and sell the Accused Infringing Devices. Verizon's users, customers, agents or other third parties who use those devices in accordance with Verizon's instructions infringe claim 10 of the '917 patent, in violation of 35 U.S.C. § 271(a). Verizon intentionally instructs its customers to infringe through support information, demonstrations, brochures and user guides, such as those located at: www.verizonwireless.com; https://www.verizonwireless.com/internet-devices/verizon-jetpack-4g-lte-mobile-hotspot-ac791l/. Verizon is thereby liable for infringement of the '917 patent under 35 U.S.C. § 271(b).

47.   Verizon also has infringed, and continues to infringe, at least claim 10 of the '917 patent by offering to commercially distribute, commercially distributing, or importing the Accused Infringing Devices which devices are used in practicing the processes, or using the systems, of the '917 patent, and constitute a material part of the invention. Verizon knows portions of the Accused Infringing Devices to be especially made or especially adapted for use in infringement of the '917 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Verizon is thereby liable for infringement of the '917 Patent under 35 U.S.C. § 271(c).

48.   Verizon is on notice of infringement of the '917 patent by no later than the filing and service of this Complaint. By the time of trial, Verizon will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of at least claim 10 of the '917 patent.

49.   Upon information and belief, Verizon may have infringed and continues to infringe the

19

'917 patent through other software and devices utilizing the same or reasonably similar functionality, including other versions of the Accused Infringing Devices.

50.   Verizon's acts of direct and indirect infringement have caused and continue to cause damage to Uniloc and Uniloc is entitled to recover damages sustained as a result of Verizon's wrongful acts in an amount subject to proof at trial.

COUNT II – INFRINGEMENT OF U.S. PATENT NO. 6,664,891

51.   The allegations of paragraphs 1-15 of this Complaint are incorporated by reference as though fully set forth herein.

52.   The '891 patent, titled "Data Delivery Through Portable Devices," issued on December 16, 2003. A copy of the '891 patent is attached as Exhibit B.

53.   Pursuant to 35 U.S.C. § 282, the '891 patent is presumed valid.

54.   Invented by Koninklijke Philips Electronics, N.V., the inventions of the '891 patent were not well-understood, routine or conventional at the time of the invention. At the time of invention of the '891 patent, the world was witnessing a great increase in mobile phone subscribers and networks through advances in technology and the addition of functionalities. '891 patent at 1:11-14. As a result, a mobile information society was developing, with personalised and localised services becoming increasingly more important. *Id*. at 1:14-17. "Context-Aware" (CA) mobile telephones were developed used with low power, short range base stations in places like shopping malls to provide location-specific information. *Id*. at 1:17-20.

55.   With Bluetooth communications protocols predicted to become a common technology in mobile communications devices, one possible solution to the problems of establishing a broadcast mode for CA applications considered was using the full current Bluetooth handshaking process to set up a two-way Bluetooth connection for data exchange between mobiles carried by consenting users selecting such a service. *Id*. at 2:4:-13. However, the Bluetooth connection protocol at the time carried the

disadvantages of: i) the time required to establish the connection before any data can be exchanged was too long (e.g., 10-30 seconds, by which time the encountering parties may be out of RF range), ii) undesirable power consumption for hand shaking transmissions on behalf of the listening device to establish network connection; iii) limits of number of active listening devices that can be addressed by a broadcasting device; and iv) loss of privacy by the listening device as its device becomes known by the broadcasting device in the process of establishing the connection. *Id*. at 2:13-34. In many opportunistic situations, the listener to a broadcast wishes their identity and location to remain anonymous and private. This was a major drawback. *Id*. Another potential solution involved a central service that registers those mobile users in proximity to a fixed infrastructure and for example compares web-stored user profiles, alerting users via Bluetooth or the cellular network of matches. *Id*. at 2:35-38. However this also suffered from some of the disadvantages above (especially privacy) and, in addition, restricted the encounters to pre-determined places where a user-locating RF beacon is installed, rather than ad-hoc encounters. *Id*. at 2:38-42.

56.   The inventive solution of the claimed inventions of the '891 patent provides a method for portable communication devices to broadcast messages to users of other portable communication devices that overcome the disadvantages of the prior art.

57.   A person of ordinary skill in the art reading the '891 patent and its claims would understand that the patent's disclosure and claims are drawn to solving a specific, technical problem arising in the field of RF communications between low power portable communications devices, such as portable telephones and suitably equipped PDAs. *Id*. at 1:4-10. Moreover, a person of ordinary skill in the art would understand that the claimed subject matter of the '891 patent presents advancements in the field of RF communications between low power portable communications devices, such as portable telephones, suitably equipped PDAs and low power beacons, and more particularly, in the field of broadcast communications between these types of devices that improves over the drawbacks of prior art

systems. *Id*. at 4:46-63.

58.   On information and belief, Verizon makes, uses, offers for sale, and sells in the United

States and/or imports into the United States a message broadcasting system in its retail stores and

provides a related mobile application to be used by its customers for receiving beacons (collectively, the

"Accused Infringing Devices").

59.   Upon information and belief, the Accused Infringing Devices infringe at least claim 14 of

the '891 patent in the exemplary manner described below.

60.   The Accused Infringing Devices include multiple portable communication devices that

broadcast messages to users of other portable devices (e.g., Verizon mobile devices including the

Verizon application). The portable communication devices are Bluetooth Low Energy (BLE) beacons

that transmit messages to other portable devices in proximity to the BLE beacons.

With over 130 million subscribers, Verizon is the largest wireless telecommunications provider in the United States. With their existing app showing its age, they engaged Fueled to upgrade and modernize their flagship mobile experience. We worked with them to design an innovative in-store experience that allows customers to interact with products and discover exclusive content as they pass through special Bluetooth Low Energy (BLE) zones within the store.

Source: https://fueled.com/projects/verizon/

Source: https://vimeo.com/137638119
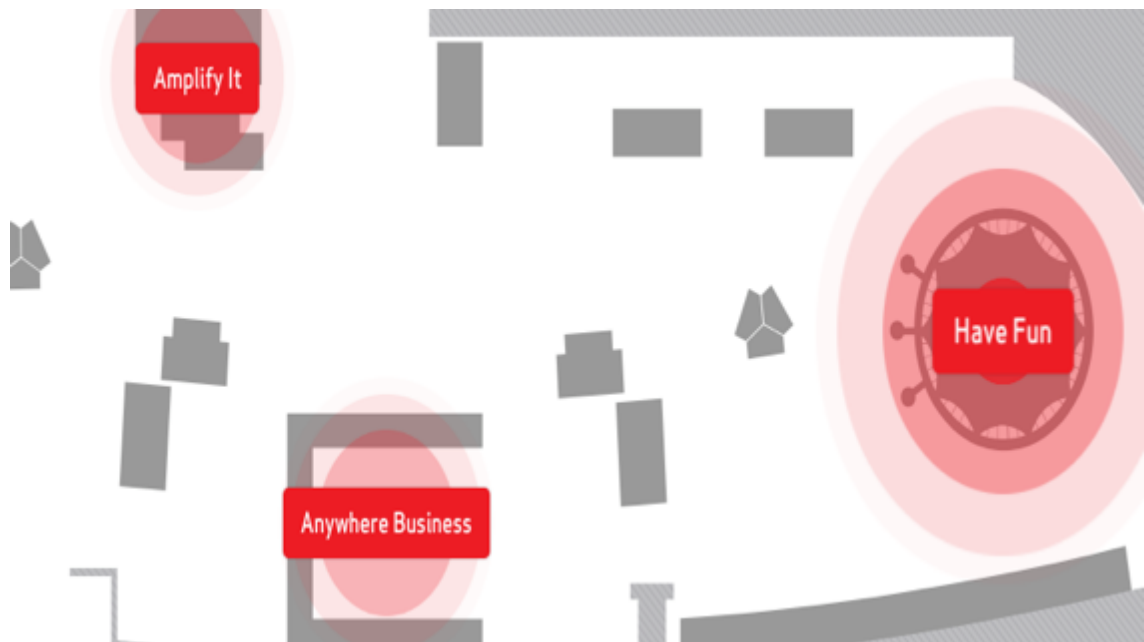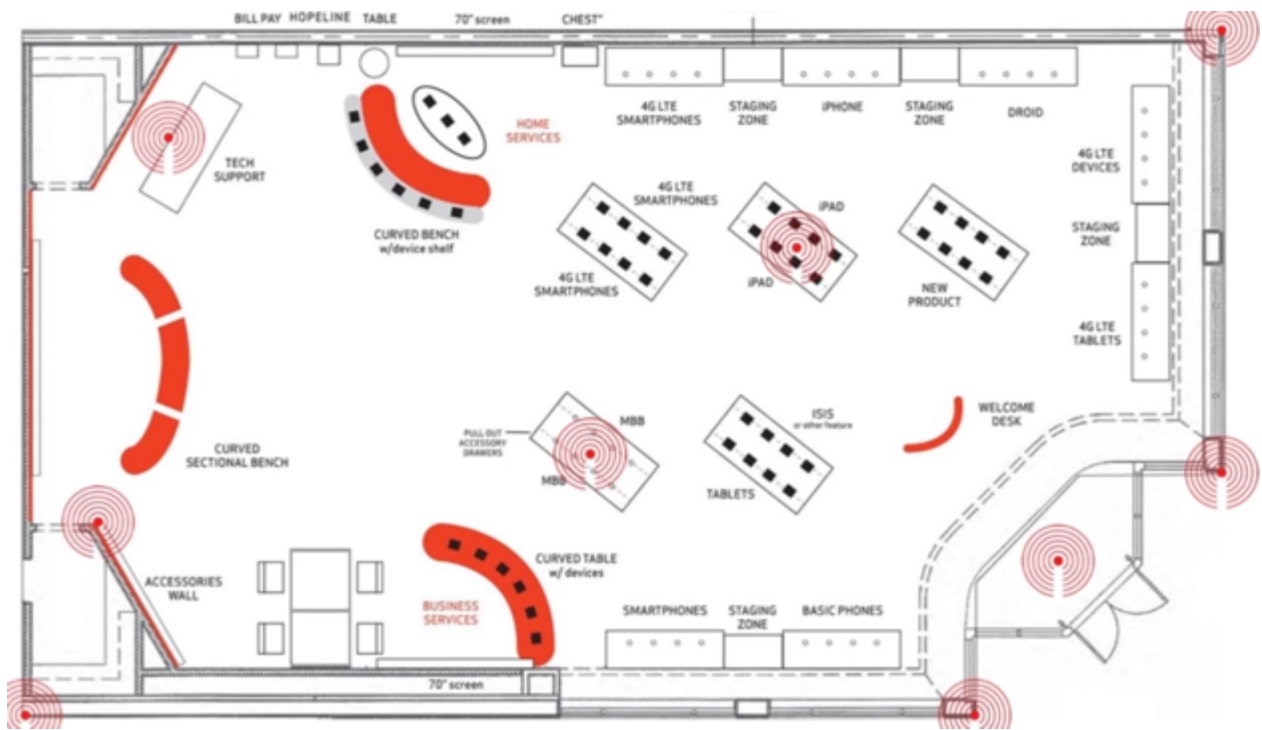
61.   The Accused Infringing Devices broadcast a series of advertisements (inquiry messages) using BLE beacons. These broadcasts are received by smart devices with BLE and the Verizon application in the vicinity of a BLE beacon.

How They Work and Where You'll Find Them

Beacons are small devices, strategically placed throughout a location, that transmit a continuous signal to any mobile device in range. Powered by *Bluetooth®* technology, these building-wide networks enable indoor positioning and location-based services, like way finding, asset management, and point-of-interest solutions.

Miami International Airport...was the first airport in the U.S. to use technology enabled by Bluetooth beacons.

75%
of top 20 retailers will deploy location-based services by 2019

Source:
Proximity Directory

Beacons are ideal for sharing information with visitors and locating and tracking valuable items or equipment. They are helping venues like museums and stadiums provide visitors with a more personalized and fulfilling experience.

Perhaps the most compelling application for beacons in recent months has been deployment in airports to monitor traffic flow and help travelers find their way around. A recent Proximity Directory report states that 84% of global airports will be using beacons by 2019.

The use cases below offer a complete look at how some airports are currently using beacon technology to enhance your travel experience.

Source: https://blog.bluetooth.com/the-rise-of-beacon-technology?_ga=2.204166291.2031574553.1534379887-1344749704.1533921295

2.5   Broadcast Interval

A beacon achieves low-power consumption by residing in sleep most of the operating time, only waking up briefly to broadcast data. The time between these broadcast events are referred to as advertising interval, which is illustrated in Figure 4. For non-connectable beacons, the interval cannot be smaller than 100 ms. For connectable beacons, it cannot be smaller than 20 ms. To this interval, a 0-10 ms pseudo-random delay is added to ensure that beacons can coexist, even if they might start broadcasting at the same time.
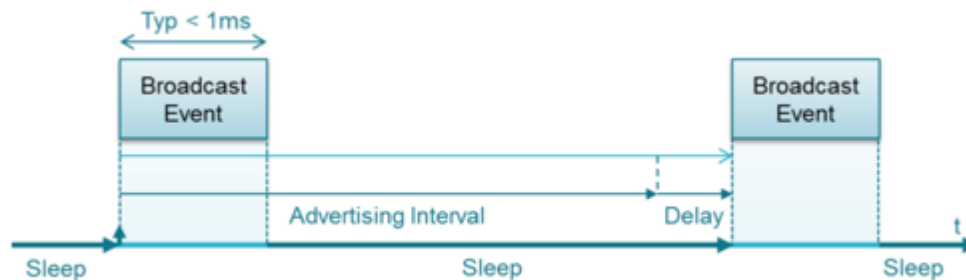
Figure 4. Advertising Interval

Source: http://www.ti.com/lit/an/swra475a/swra475a.pdf

Source: https://fueled.com/projects/verizon/

Source: https://vimeo.com/137638119
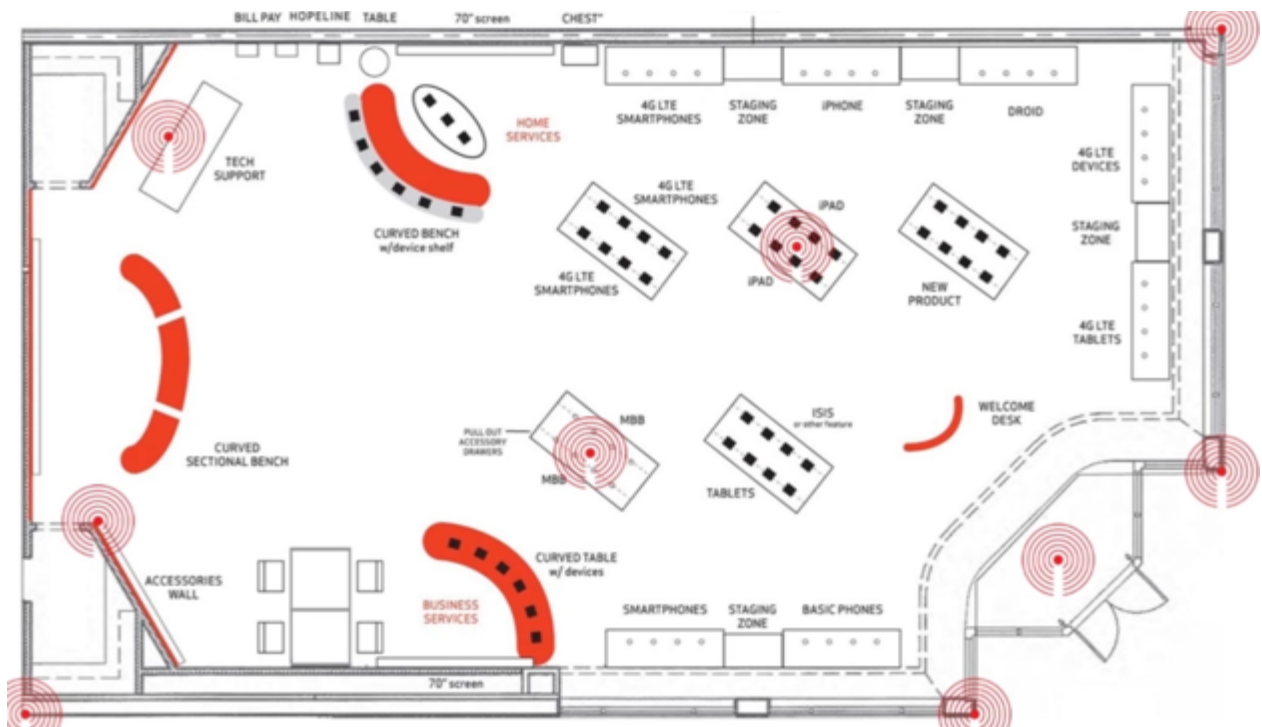
62.   Bluetooth advertisements (inquiry messages) as transmitted by the beacons contain a plurality of predetermined data fields, such as the preamble, Access address, PDU header and Broadcast address.

Figure 2. Bluetooth low energy Broadcast Data
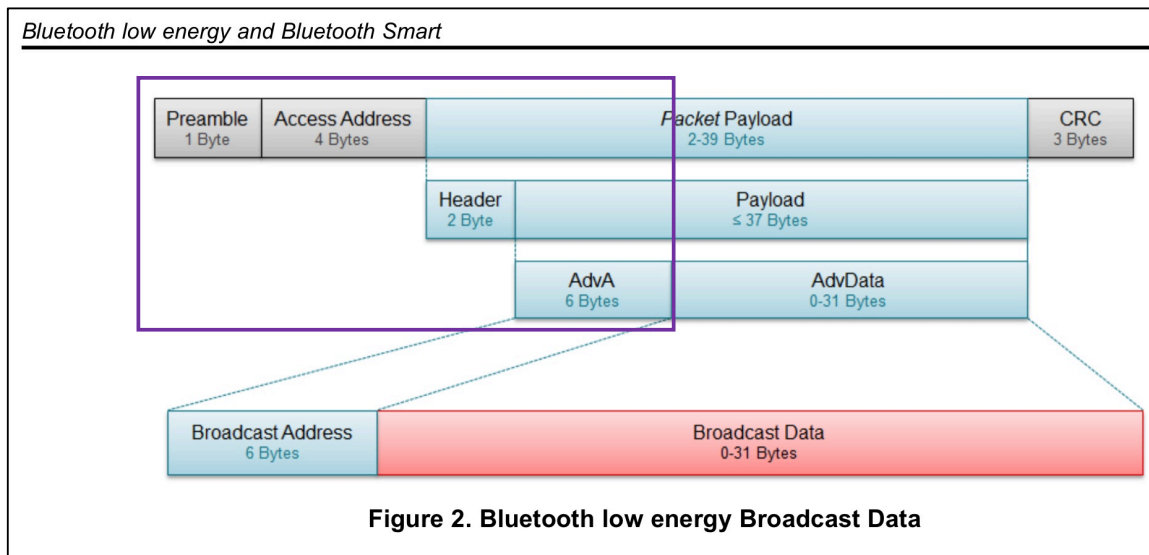
Source: http://www.ti.com/lit/an/swra475a/swra475a.pdf
Application Report SWRA475A–January 2015–Revised October 2016, Bluetooth® low energy Beacons, p4

63.   During an advertising event, an advertiser broadcasts an advertising packet, repeated on each of the three advertising channels. As soon as an advertiser has sent its set of three advertising packets, the advertiser will close the advertising event. The advertiser may then repeat the advertising event or start a new event after a defined period T_advEvent. Each advertising packet broadcasted by an advertiser is in the form of a plurality of predetermined data fields, e.g., A Preamble and an Access Address, which together constitute an "inquiry message." Thus the Preambles and the Access Addresses for a plurality of advertising packets broadcast during one or more advertising events constitute a "series of inquiry messages."

3.3.2.2.2 Characteristics

The LE advertisement broadcast channel is a set of three fixed PHY channels spread evenly across the LE frequency spectrum. The number of advertising PHY channels can be reduced by the advertising device in order to reduce interference. All advertising packets use a fixed Access Address.

The channel is divided into advertising events where each advertising event can hop on all three advertising PHY channels. Consecutive advertising events begin on the first advertising PHY channel. The advertising events occur at regular intervals which are slightly modified with a random delay to aid in inter-ference avoidance.

On the LE advertising broadcast channel the advertising device controls access to the channel. The advertising device starts its transmission in an advertising event and transmits advertising packets on one or more of the three advertising PHY channels. Each advertising packet is sent on a different adver-tising PHY channel at a fixed interval. Four types of advertising events can be

30 June 2010	Data Transport Architecture

BLUETOOTH SPECIFICATION Version 4.0 [Vol 1]   page 57 of 140

Architecture   **Bluetooth®**

used, with each advertising event type having different sized advertising pack-ets. These advertising packets can vary in length from 8 to 39 octets.

Some advertising events sent by the advertising device permit the listening device to concurrently send scan requests or connection requests packets on the same advertising PHY channel in which the advertising packet was received. The advertising device can send a scan response packet again on the same advertising PHY channel within the same advertising event. The scan response packet can vary in length from 8 to 39 octets.

Source: Bluetooth Specification Version 4.0; §3.3.2.2.2

3.2.2 LE Generic Packet Structure

The general structure of the link layer air interface packet closely reflects the architectural layers found in the LE system. The LE packet structure is designed for optimal use in normal operation. It is shown in Figure 3.5.
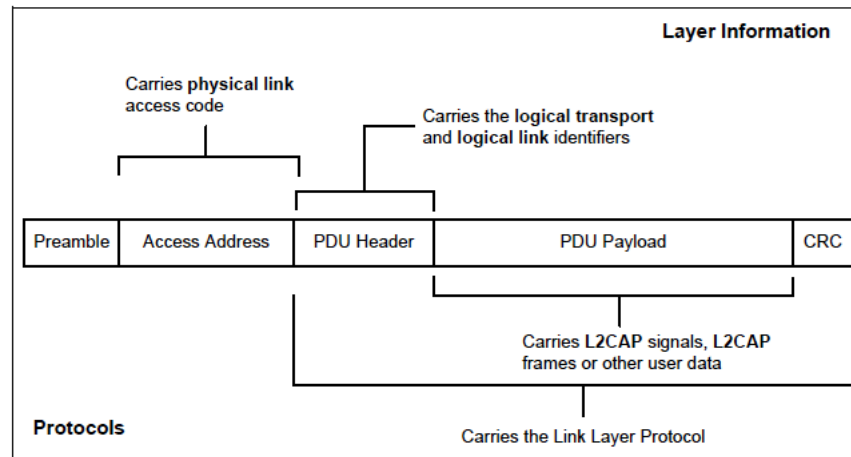

Figure 3.5: LE packet structure

Source: Bluetooth Specification Version 4.0; §3.2.2

64.   The beacon advertisements add a broadcast message prior to transmission such that suitably configured other portable devices may receive the transmitted inquiry messages. The Verizon application is used to suitably configure other portable devices to receive the transmitted inquiry messages and read the broadcast data from said additional data field. For example, the broadcast message may include identification information that allows the Verizon application to recognize beacon advertisements that are sent to it. The Bluetooth Core Specification Version 4.0 specifies the following four types of advertising packets: ADV_IND, ADV_DIRECT_IND, ADV_SCAN_IND and ADV_NONCONN_IND. For certain types of advertising packets being broadcast (i.e., ADV_IND, ADV_SCAN_IND and ADV_NONCONN_IND), an advertiser adds at the end of the Access Address (see Fig. 3.5), prior to transmission, an advertising channel PDU comprising a PDU header and A PDU Payload. The PDU Payload consists of an AdvA field and an AdvData field and the AdvData field may carry broadcast message data in the form of advertising data. An advertising channel PDU carrying such advertising data constitutes the "additional data field" as claimed. In addition, for an advertising event,

the advertiser will broadcast an advertising packet with such an added advertising channel PDU and associated advertising data, repeated on each of the three advertising channels and then may repeat the advertising event or start a new event, such that suitably configured initiators/scanners receiving the advertising packets may read the advertising data.
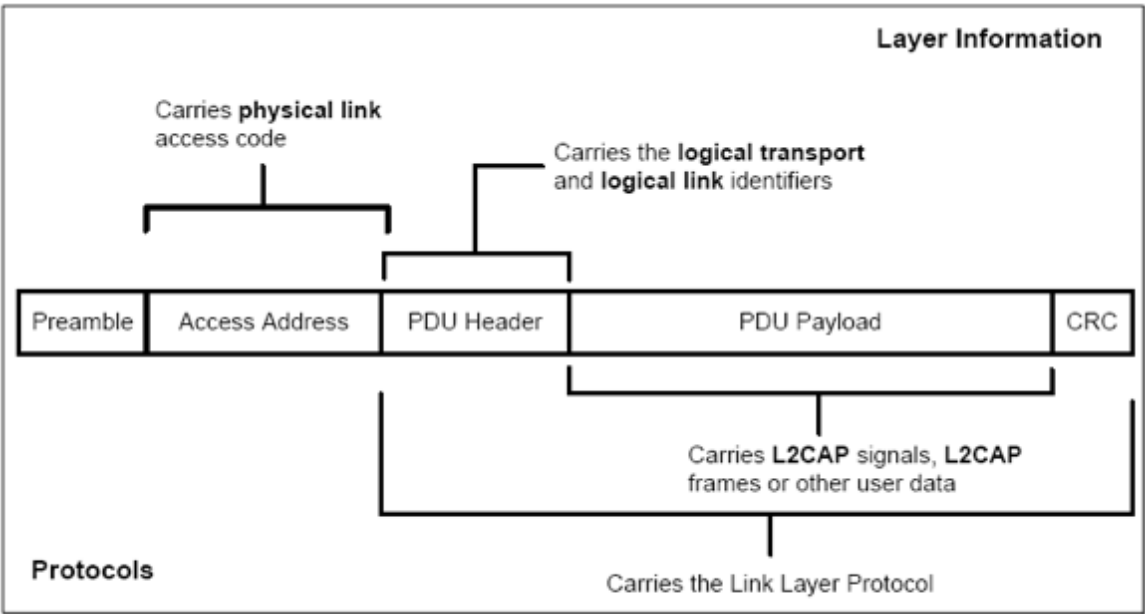
Figure 3.5: LE packet structure

Source: Bluetooth Specification Version 4.0, Vol. 1 §3.2.2

Figure 2.4: ADV_IND PDU Payload

Source: Bluetooth Specification Version 4.0, Vol. 6 §2.3.1.1

Figure 2.6: ADV_NONCONN_IND PDU Payload

Source: Bluetooth Specification Version 4.0, Vol. 6 §2.3.1.3

Figure 2.7: ADV_SCAN_IND PDU Payload

Source: Bluetooth Specification Version 4.0, Vol. 6 §2.3.1.4

Lifestyle Zones

Verizon's Lifestyle Zones are hubs of products tied to particular use cases, like working out or viewing digital media. We sought to create digital incarnations of those zones that automatically pop up on device as users walk into various LIfestyle Zones. These digital versions include products beyond what's available in-store as well as videos, tips, and reviews for products. It was important to us that the digital features enhance rather than duplicate in-store capabilities.

Source: https://fueled.com/projects/verizon/

Source: https://vimeo.com/137638119
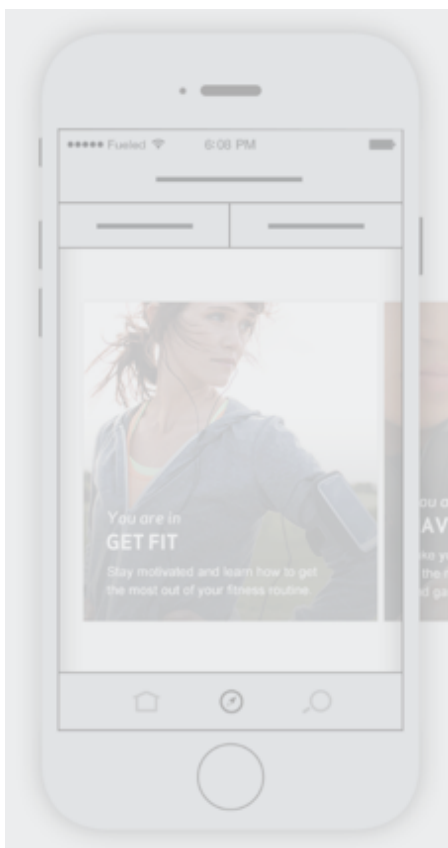
65.   Verizon has infringed, and continues to infringe, at least claim 14 of the '891 patent in the United States, by making, using, offering for sale, selling and/or importing the Accused Infringing Devices in violation of 35 U.S.C. § 271(a).

66.   Verizon also has infringed, and continues to infringe, at least claim 1 of the '891 patent by actively inducing others to use the Accused Infringing Devices. Verizon's users, customers, agents or other third parties who use the Accused Infringing Devices in accordance with Verizon's instructions infringe claim 1 of the '891 patent, in violation of 35 U.S.C. § 271(a). Verizon intentionally instructs its customers to infringe through support information, demonstrations, brochures and user guides, such as

those located at: www.verizonwireless.com/support/; https://www.verizonwireless.com/solutions-and-services/my-verizon-mobile/; https://www.verizonwireless.com/support/knowledge-base-205826/. Verizon is thereby liable for infringement of the '891 patent under 35 U.S.C. § 271(b).

67.   Verizon also has infringed, and continues to infringe, at least claim 1 of the '891 patent by offering to commercially distribute, commercially distributing, or operating the Accused Infringing Devices which are used in practicing the processes, or using the systems, of the '891 patent, and constitute a material part of the invention. Verizon knows portions of the Accused Infringing Devices to be especially made or especially adapted for use in infringement of the '891 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Verizon is thereby liable for infringement of the '891 patent under 35 U.S.C. § 271(c).

68.   Verizon is on notice of infringement of the '891 patent by no later than the filing and service of this Complaint. By the time of trial, Verizon will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of at least claim 1 of the '891 patent.

69.   Upon information and belief, Verizon may have infringed and continues to infringe the '891 patent through other network technology utilizing the same or reasonably similar functionality, including other versions of the Accused Infringing Devices.

70.   Verizon's acts of direct and indirect infringement have caused and continue to cause damage to Uniloc and Uniloc is entitled to recover damages sustained as a result of Verizon's wrongful acts in an amount subject to proof at trial.

COUNT III – INFRINGEMENT OF U.S. PATENT NO. 6,519,005

71.   The allegations of paragraphs 1-15 of this Complaint are incorporated by reference as though fully set forth herein.

72.   The '005 patent, titled "Method Of Concurrent Multiple-Mode Motion Estimation For

Digital Video" issued on February 11, 2003. A copy of the '005 patent is attached as Exhibit C.

73.   Pursuant to 35 U.S.C. § 282, the '005 patent is presumed valid.

74.   Invented by Koninklijke Philips Electronics N.V., the inventions of the '005 patent were not well-understood, routine or conventional at the time of the invention. At the time of invention of the '005 patent, different compression algorithms had been developed for digitally encoding video and audio information (hereinafter referred to generically as "digital video data stream") in order to minimize the bandwidth required to transmit this digital video data stream for a given picture quality. '005 patent at 1:12-17. Several multimedia specification committees established and proposed standards for encoding/compressing and decoding/decompressing audio and video information. The most widely accepted international standards have been proposed by the Moving Pictures Expert Group (MPEG). *Id.* at 1:17-22 Video coding, such as MPEG coding, involves a number of steps. In general, in accordance with the MPEG standards, the audio and video data comprising a multimedia data stream (or "bit stream") are encoded/compressed in an intelligent manner using a compression technique generally known as "motion coding". *Id.* at 1:41-45. More particularly, rather than transmitting each video frame in its entirety, MPEG uses motion estimation for only those parts of sequential pictures that vary due to motion, where possible. *Id.* at 45-48. In general, the picture elements or "pixels" of a picture are specified relative to those of a previously transmitted reference or "anchor" picture using differential or "residual" video, as well as so-called "motion vectors" that specify the location of a 16-by-16 array of pixels or "macroblock" within the current picture relative to its original location within the anchor picture. *Id.* at 1:48-55. Computation of the motion vector(s) for a given macroblock involves an exhaustive search procedure that is very computationally intensive. *Id.* at 3:25-39. It was desirable at the time of the invention to improve this process. *Id.* at 3:40-67.

75.   The inventive solution of the claimed inventions of the '005 patent provides a system and method for digital video compression, and, more particularly, to a motion estimation method and search

engine for a digital video encoder that is simpler, faster, and less expensive than prior art technology, and that permits concurrent motion estimation using multiple prediction modes. *Id*. at 1:6-11.

76.   A person of ordinary skill in the art reading the '005 patent and its claims would understand that the patent's disclosure and claims are drawn to solving a specific, technical problem arising in the field of digital video compression. *Id*.

77.   On information and belief, Verizon's Uplynk Video Streaming and FiOS services and their related encoders provide a method for motion coding an uncompressed digital video data stream (collectively the "Accused Infringing Devices").

78.   Upon information and belief, the Accused Infringing Devices infringe at least claim 1 of the '005 patent in the exemplary manner described below.

79.   The Accused Infringing Devices provide a method for motion coding an uncompressed digital video data stream. The Accused Infringing Devices receive input video streams which are then encoded and/or transcoded using at least the H.264 standard. This is a widely used video compression format with decoder support on web browsers, TVs and other consumer devices. The H.264 standard uses motion compressor and estimator for motion coding video streams.

Encode & playback

Encode once. Play everywhere.

Streaming is broken. Our Uplynk Video Streaming service provides simplified online video encoding that allows you to reach multiple platforms with just a single workflow.
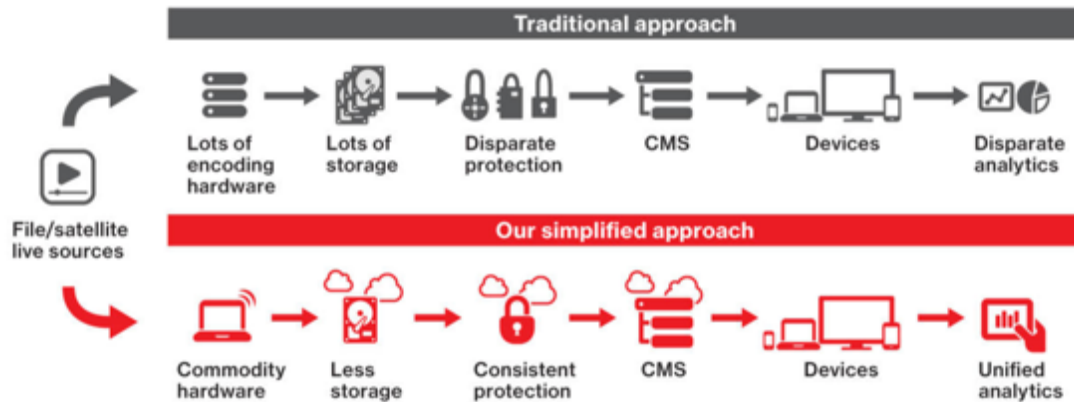
Simplifying the entire process

Don't pay more for encoding, storage, encryption and distribution and expensive, proprietary encoding appliances. By using a single workflow across all platforms, we'll help you collapse your workflow into one for high-quality consistent viewer experiences that scale to every device, easily and cost effectively.

Upload & encode

How does it work?

A small app, called the Slicer runs on basic hardware in your facility (a laptop will do). The Slicer's patent-pending process chops your video into smaller pieces of work, encrypts them, and then pushes them into the cloud for encoding. You get the security benefits of having your own hardware, but with the cost and scalability benefits of the cloud.

No capex, less opex

Hardware encoders aren't the only cost savings. You also won't need third-party upload tools, and the egress bandwidth requirements are less than traditional methods.

Simpler

The Slicer takes care of all the heavy lifting. It creates a single workflow that will work across all platforms, and ensures important data like closed captioning is preserved.

Faster

Because upload and encode happen in parallel, encode finishes seconds after upload. Files are validated upfront, so you'll never upload a 30GB video only to discover it's invalid.

Adaptive HD, always

High definition, adaptive streaming is included in our service for free. The Slicer automatically calculates ideal encoding settings to ensure your content looks great on all devices.

Cinematic sound

Dolby Audio support means your audience can enjoy vibrant, high-quality sound with enhanced stereo, and up to 7.1 multichannel audio, delivered to all leading streaming platforms.

Live and on demand

The Slicer process works the same for both live and on-demand content, providing unprecedented flexibility down the road.

Non-proprietary

Content is encoded to standard H.264 for video and AAC for audio. Don't worry, you're not getting locked into something proprietary.

Source: https://www.verizondigitalmedia.com/platform/uplynk-video-streaming/encode-and-playback/

0.6   Overview of the design characteristics

This subclause does not form an integral part of this Recommendation | International Standard.

The coded representation specified in the syntax is designed to enable a high compression capability for a desired image quality. With the exception of the transform bypass mode of operation for lossless coding in the High 4:4:4 Intra, CAVLC 4:4:4 Intra, and High 4:4:4 Predictive profiles, and the I_PCM mode of operation in all profiles, the algorithm is typically not lossless, as the exact source sample values are typically not preserved through the encoding and decoding processes. A number of techniques may be used to achieve highly efficient compression. Encoding algorithms (not specified in this Recommendation | International Standard) may select between inter and intra coding for block-shaped regions of each picture. Inter coding uses motion vectors for block-based inter prediction to exploit temporal statistical dependencies between different pictures. Intra coding uses various spatial prediction modes to exploit spatial statistical dependencies in the source signal for a single picture. Motion vectors and intra prediction modes may be specified for a variety of block sizes in the picture. The prediction residual is then further compressed using a transform to remove spatial correlation inside the transform block before it is quantised, producing an irreversible process that typically discards less important visual information while forming a close approximation to the source samples. Finally, the motion vectors or intra prediction modes are combined with the quantised transform coefficient information and encoded using either variable length coding or arithmetic coding.

0.6.1   Predictive coding

This subclause does not form an integral part of this Recommendation | International Standard.

Because of the conflicting requirements of random access and highly efficient compression, two main coding types are specified. Intra coding is done without reference to other pictures. Intra coding may provide access points to the coded sequence where decoding can begin and continue correctly, but typically also shows only moderate compression efficiency. Inter coding (predictive or bi-predictive) is more efficient using inter prediction of each block of sample values from some previously decoded picture selected by the encoder. In contrast to some other video coding standards, pictures coded using bi-predictive inter prediction may also be used as references for inter coding of other pictures.

The application of the three coding types to pictures in a sequence is flexible, and the order of the decoding process is generally not the same as the order of the source picture capture process in the encoder or the output order from the decoder for display. The choice is left to the encoder and will depend on the requirements of the application. The

decoding order is specified such that the decoding of pictures that use inter-picture prediction follows later in decoding order than other pictures that are referenced in the decoding process.

Source: H.264 Standard (03-2010) at pp. 3-4

H.264/AVC Encoder [2]

Source: https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf
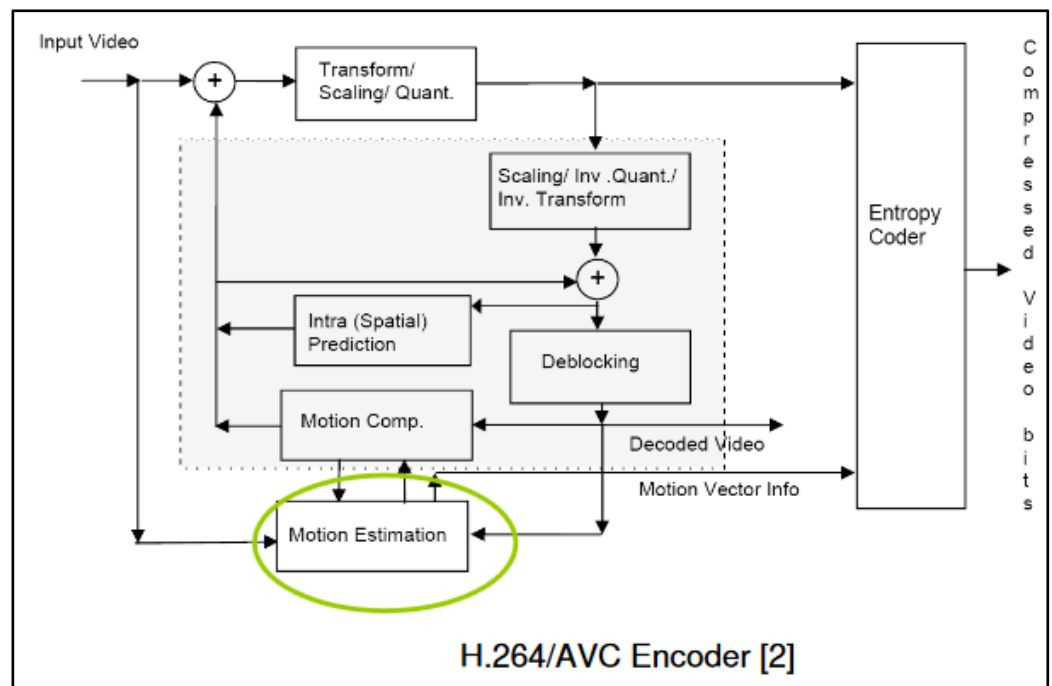
80.   The Accused Infringing Devices practice a method of comparing pixels of a first pixel array (e.g., a macroblock) in a picture currently being coded with pixels of a plurality of second pixel arrays in at least one reference picture and concurrently performing motion estimation for each of a plurality of different prediction modes in order to determine which of the prediction modes is an optimum prediction mode. The H.264 standard uses different motion estimation modes in inter-frame prediction. These modes are commonly referred to as inter-frame prediction modes, or inter modes. Each inter mode involves partitioning the current Macroblock into a different combination of sub blocks, and selecting the optimum motion vector for the current Macroblock based on the partition. The inter-frame prediction modes, or inter modes, can be further categorized by the number and position of the reference frames, as well as the choice of integer pixel, half pixel and quarter pixel values in motion estimation. The Verizon H.264 encoders concurrently perform motion estimation of a Macroblock for all inter-modes and select the most optimum prediction mode with least rate distortion cost.

Mode Decision

16x16 luma Macroblock

Intra Modes
(For all frames)

• Nine 4x4 Modes
• Four 16x16 Modes

Inter Modes (Only for P and B-frames)

• Macroblock partitions: 16x16,16x8,8x16, 8x8,8x4,4x8,4x4
• Use of reference frames
• Use of integer, half and quarter pixel motion estimation

• Each mode (inter or intra) has an associated Rate-Distortion (RD) cost.
• Encoder performs mode decision to select the mode having the least RD cost. This process is computationally intensive.

Source: https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf, p. 30

81.   H.264 provides a hierarchical way to partition a Macroblock, with the available partitions shown in the following two figures. An exemplary inter-frame prediction mode, or inter mode, can be for a Macroblock to be partitioned to encompass a 16x8 sub block on the left, and two 8x8 sub blocks on the right.

Macroblock Partitions

8x8	8x8
8x8	8x8

16x16

| 16x8 | 16x8 |

16x16

8x16
8x16

16x16

16x16 blocks can be broken into blocks of sizes 8x8, 16x8, or 8x16.

4x4	4x4
4x4	4x4

8x8

| 8x4 | 8x4 |

8x8

4x8
4x8

8x8

8x8 blocks can be broken into blocks of sizes 4x4, 4x8, or 8x4.

Source: https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf, p. 4

1 macroblock partition of 16*16 luma samples and associated chroma samples	2 macroblock partitions of 16*8 luma samples and associated chroma samples	2 macroblock partitions of 8*16 luma samples and associated chroma samples	4 sub-macroblocks of 8*8 luma samples and associated chroma samples
Macroblock partitions: 0	0 / 1	0 | 1	0 | 1 / 2 | 3

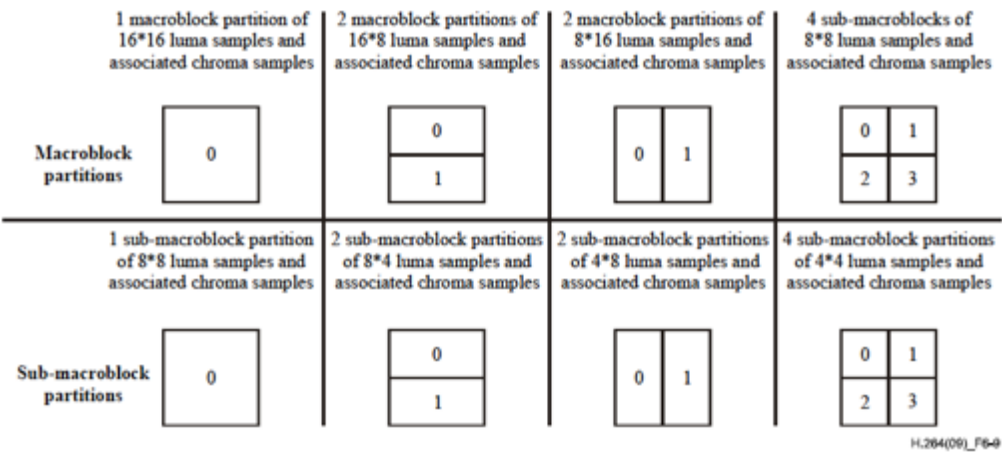| 1 sub-macroblock partition of 8*8 luma samples and associated chroma samples	2 sub-macroblock partitions of 8*4 luma samples and associated chroma samples	2 sub-macroblock partitions of 4*8 luma samples and associated chroma samples	4 sub-macroblock partitions of 4*4 luma samples and associated chroma samples
Sub-macroblock partitions: 0	0 / 1	0 | 1	0 | 1 / 2 | 3

H.264(09)_F6-9

Figure 6-9 – Macroblock partitions, sub-macroblock partitions, macroblock partition scans, and sub-macroblock partition scans

Source: Source: H.264 Standard (03-2010) at p. 26

82.   The optimum prediction mode as chosen for the current Macroblock is embedded in the compressed bit stream of H.264, as shown in the following two syntaxes.

7.3.5.1   Macroblock prediction syntax

mb_pred(mb_type) {	C	Descriptor
if(MbPartPredMode(mb_type, 0) == Intra_4x4 || MbPartPredMode(mb_type, 0) == Intra_16x16) {		
if(MbPartPredMode(mb_type, 0) == Intra_4x4)		
for(luma4x4BlkIdx=0; luma4x4BlkIdx<16; luma4x4BlkIdx++) {		
prev_intra4x4_pred_mode_flag[luma4x4BlkIdx]	2	u(1) | ae(v)
if(!prev_intra4x4_pred_mode_flag[luma4x4BlkIdx])		
rem_intra4x4_pred_mode[luma4x4BlkIdx]	2	u(3) | ae(v)
}		
intra_chroma_pred_mode	2	ue(v) | ae(v)
} else if(MbPartPredMode(mb_type, 0) != Direct) {		
for(mbPartIdx = 0; mbPartIdx < NumMbPart(mb_type); mbPartIdx++)		
if((num_ref_idx_l0_active_minus1 > 0 || mb_field_decoding_flag) && MbPartPredMode(mb_type, mbPartIdx) != Pred_L1)		
ref_idx_l0[mbPartIdx]	2	te(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < NumMbPart(mb_type); mbPartIdx++)		
if((num_ref_idx_l1_active_minus1 > 0 || mb_field_decoding_flag) && MbPartPredMode(mb_type, mbPartIdx) != Pred_L0)		
ref_idx_l1[mbPartIdx]	2	te(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < NumMbPart(mb_type); mbPartIdx++)		
if(MbPartPredMode (mb_type, mbPartIdx) != Pred_L1)		
for(compIdx = 0; compIdx < 2; compIdx++)		
mvd_l0[mbPartIdx][0][compIdx]	2	se(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < NumMbPart(mb_type); mbPartIdx++)		
if(MbPartPredMode(mb_type, mbPartIdx) != Pred_L0)		
for(compIdx = 0; compIdx < 2; compIdx++)		
mvd_l1[mbPartIdx][0][compIdx]	2	se(v) | ae(v)
}		
}		

Source: H.264 Standard (03-2010) at p. 57

7.3.5.2   Sub-macroblock prediction syntax

sub_mb_pred(mb_type) {	C	Descriptor
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		
sub_mb_type[mbPartIdx]	2	ue(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		

if((num_ref_idx_l0_active_minus1 > 0 || mb_field_decoding_flag) &&
       mb_type != P_8x8ref0 &&
       sub_mb_type[mbPartIdx] != B_Direct_8x8 &&
       SubMbPredMode(sub_mb_type[mbPartIdx]) != Pred_L1)		

ref_idx_l0[mbPartIdx]	2	te(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		

if((num_ref_idx_l1_active_minus1 > 0 || mb_field_decoding_flag) &&
       sub_mb_type[mbPartIdx] != B_Direct_8x8 &&
       SubMbPredMode(sub_mb_type[mbPartIdx]) != Pred_L0)		

ref_idx_l1[mbPartIdx]	2	te(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		
if(sub_mb_type[mbPartIdx] != B_Direct_8x8 && SubMbPredMode(sub_mb_type[mbPartIdx]) != Pred_L1)		

for(subMbPartIdx = 0;
         subMbPartIdx < NumSubMbPart(sub_mb_type[mbPartIdx]);
         subMbPartIdx++)		

for(compIdx = 0; compIdx < 2; compIdx++)		
mvd_l0[mbPartIdx][subMbPartIdx][compIdx]	2	se(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		
if(sub_mb_type[mbPartIdx] != B_Direct_8x8 && SubMbPredMode(sub_mb_type[mbPartIdx]) != Pred_L0)		

for(subMbPartIdx = 0;
         subMbPartIdx < NumSubMbPart(sub_mb_type[mbPartIdx]);
         subMbPartIdx++)		

for(compIdx = 0; compIdx < 2; compIdx++)		
mvd_l1[mbPartIdx][subMbPartIdx][compIdx]	2	se(v) | ae(v)
}		

Source: H.264 Standard (03-2010) at p. 58

83.   The Accused Infringing Devices provide a method for determining which of the second pixel arrays (e.g., macroblock) constitutes a best match with respect to the first pixel array (e.g., macroblock) for the optimum prediction mode.

Fig. 2.4: Motion estimation. For each MB the best matching block in the reference frame is found. The encoder codes the differences (errors) between the MBs and their best matching blocks. Arrows indicate motion vectors and are labeled by the vector coordinates. In this example the shapes are identical but their colors are slightly larger/darker.
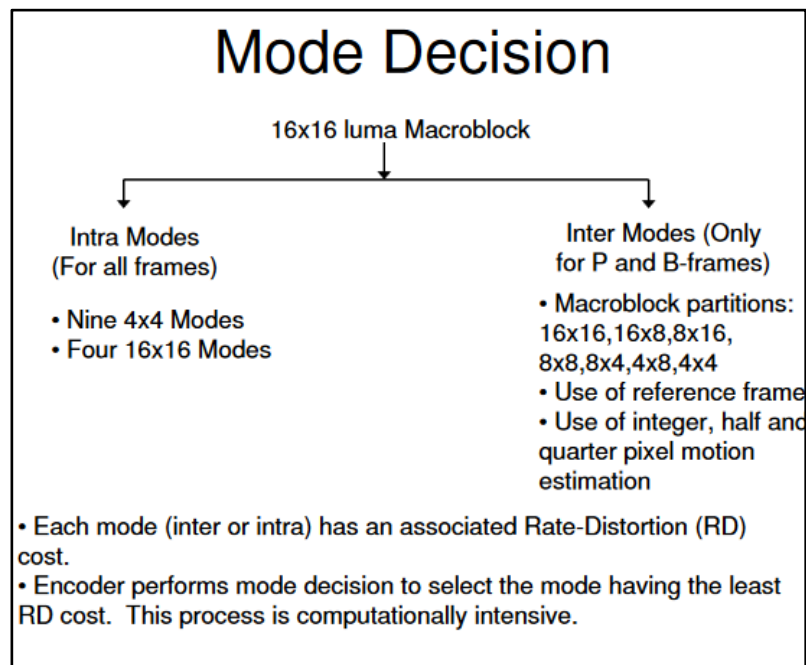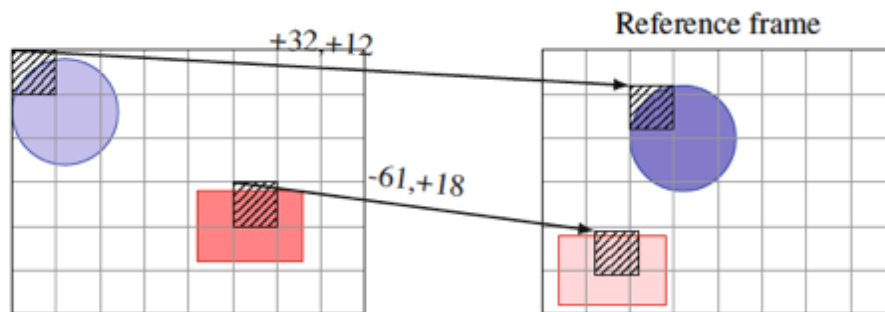
Source: B. Juurlink et al., Scalable Parallel Programming Applied to H.264, Chapter 2: Understanding the Application: An Overview of the H.264 Standard, p. 12

84.   The encoder in the Accused Infringing Devices performs mode decision to select the most

optimum prediction mode with least rate distortion cost.

The following semantics are assigned to the macroblock types in Table 7-13:

–   P_L0_16x16: the samples of the macroblock are predicted with one luma macroblock partition of size 16x16 luma samples and associated chroma samples.

–   P_L0_L0_MxN, with MxN being replaced by 16x8 or 8x16: the samples of the macroblock are predicted using two luma partitions of size MxN equal to 16x8, or two luma partitions of size MxN equal to 8x16, and associated chroma samples, respectively.

–   P_8x8: for each sub-macroblock an additional syntax element (sub_mb_type[mbPartIdx] with mbPartIdx being the macroblock partition index for the corresponding sub-macroblock) is present in the bitstream that specifies the type of the corresponding sub-macroblock (see subclause 7.4.5.2).

–   P_8x8ref0: has the same semantics as P_8x8 but no syntax element for the reference index (ref_idx_l0[mbPartIdx] with mbPartIdx = 0..3) is present in the bitstream and ref_idx_l0[mbPartIdx] shall be inferred to be equal to 0 for all sub-macroblocks of the macroblock (with indices mbPartIdx = 0..3).

–   P_Skip: no further data is present for the macroblock in the bitstream.

Source: H.264 Standard (03-2010), p. 100

43

Mode Decision

16x16 luma Macroblock

Intra Modes
(For all frames)

• Nine 4x4 Modes
• Four 16x16 Modes

Inter Modes (Only for P and B-frames)

• Macroblock partitions: 16x16,16x8,8x16, 8x8,8x4,4x8,4x4
• Use of reference frame
• Use of integer, half and quarter pixel motion estimation

• Each mode (inter or intra) has an associated Rate-Distortion (RD) cost.
• Encoder performs mode decision to select the mode having the least RD cost. This process is computationally intensive.

Source: https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf, p. 30

85.   The Accused Infringing Devices provide a method for generating a motion vector for the first pixel array in response to the determining step. The encoder calculates the appropriate motion vectors and other data elements represented in the video data stream.

Reference frame

+32,+12

-61,+18

Fig. 2.4: Motion estimation. For each MB the best matching block in the reference frame is found. The encoder codes the differences (errors) between the MBs and their best matching blocks. Arrows indicate motion vectors and are labeled by the vector coordinates. In this example the shapes are identical but their colors are slightly larger/darker.

Source: B. Juurlink et al., Scalable Parallel Programming Applied to H.264, Chapter 2: Understanding the Application: An Overview of the H.264 Standard, p. 12

1. The derivation process for motion vector components and reference indices as specified in subclause 8.4.1 is invoked.

    Inputs to this process are:

    –   a macroblock partition mbPartIdx,

    –   a sub-macroblock partition subMbPartIdx.

    Outputs of this process are:

    –   luma motion vectors mvL0 and mvL1 and when ChromaArrayType is not equal to 0, the chroma motion vectors mvCL0 and mvCL1

    –   reference indices refIdxL0 and refIdxL1

    –   prediction list utilization flags predFlagL0 and predFlagL1

    –   the sub-macroblock partition motion vector count subMvCnt.

Source: H.264 Standard (03-2010), p. 151

H.264/AVC Encoder [2]
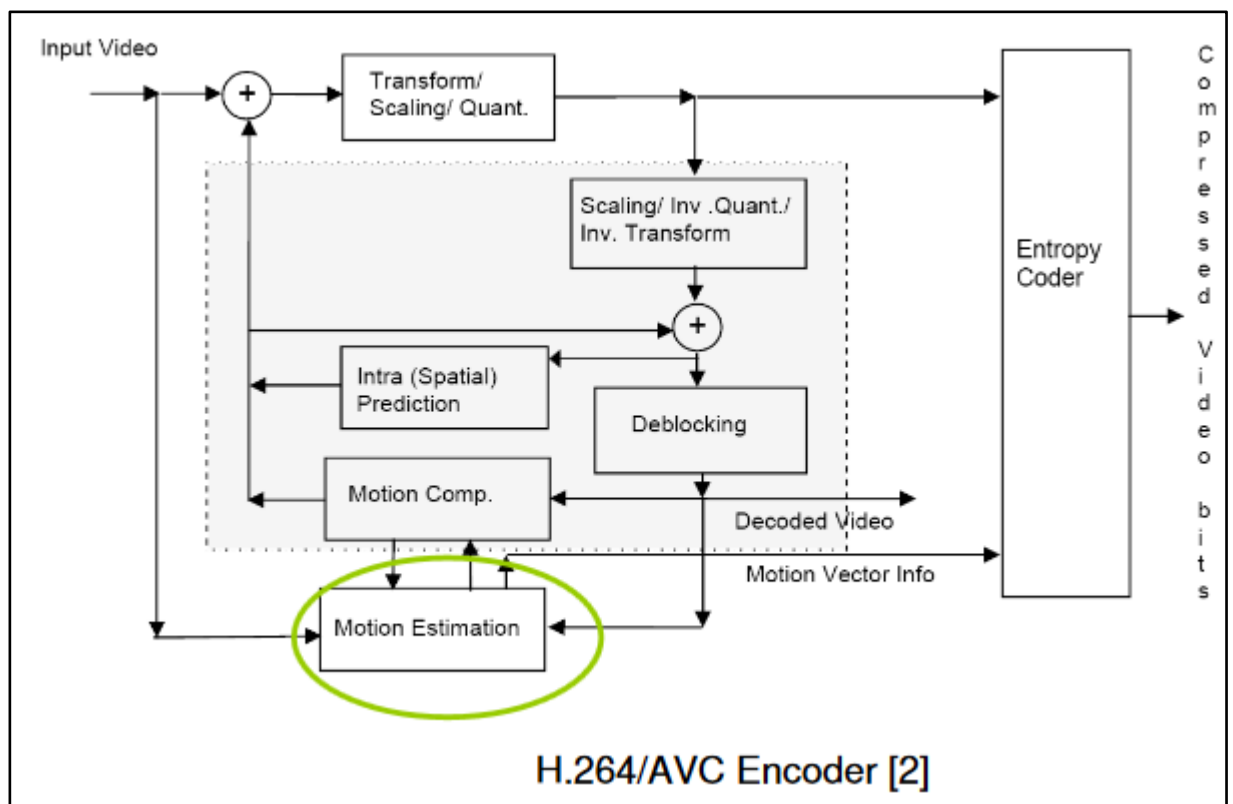
Source: https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf, p. 2

86.   Verizon has infringed, and continues to infringe, at least claim 1 of the '005 patent in the United States, by making, using, offering for sale, selling and/or importing the Accused Infringing Devices in violation of 35 U.S.C. § 271(a).

87.   Verizon also has infringed, and continues to infringe, at least claim 1 of the '005 patent by

actively inducing others to use the Accused Infringing Devices. Verizon's users, customers, agents or other third parties who use the Accused Infringing Devices in accordance with Verizon's instructions infringe claim 1 of the '005 patent, in violation of 35 U.S.C. § 271(a). Verizon intentionally instructs its customers to infringe through support information, demonstrations, brochures and user guides, such as those located at: https://www.verizondigitalmedia.com/platform/uplynk-video-streaming/; https://www.verizondigitalmedia.com/platform/uplynk-video-streaming/encode-and-playback/; https://www.verizon.com/home/fios/; fios.verizon.com. Verizon is thereby liable for infringement of the '005 patent under 35 U.S.C. § 271(b).

88.   Verizon also has infringed, and continues to infringe, at least claim 1 of the '005 patent by offering to commercially distribute, commercially distributing, or operating the Accused Infringing Devices which are used in practicing the processes, or using the systems, of the '005 patent, and constitute a material part of the invention. Verizon knows portions of the Accused Infringing Devices to be especially made or especially adapted for use in infringement of the '005 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Verizon is thereby liable for infringement of the '005 Patent under 35 U.S.C. § 271(c).

89.   Verizon is on notice of infringement of the '005 patent by no later than the filing and service of this Complaint. By the time of trial, Verizon will have known and intended (since receiving such notice) that its continued actions would actively induce and contribute to the infringement of at least claim 1 of the '005 patent.

90.   Upon information and belief, Verizon may have infringed and continues to infringe the '005 patent through other network technology utilizing the same or reasonably similar functionality, including other versions of the Accused Infringing Devices.

91.   Verizon's acts of direct and indirect infringement have caused and continue to cause damage to Uniloc and Uniloc is entitled to recover damages sustained as a result of Verizon's wrongful

acts in an amount subject to proof at trial.

COUNT IV – INFRINGEMENT OF U.S. PATENT NO. 7,016,676

92.   The allegations of paragraphs 1-15 of this Complaint are incorporated by reference as though fully set forth herein.

93.   The '676 patent, titled "Method, Network And Control Station For the Two-Way Alternate Control Of Radio Systems of Different Standards In The Same Frequency Band," issued on March 21, 2006. A copy of the '676 patent is attached as Exhibit D.

94.   Pursuant to 35 U.S.C. § 282, the '676 patent is presumed valid.

95.   Invented by Koninklijke Philips Electronics, N.V., the inventions of the '676 patent were not well-understood, routine or conventional at the time of the invention. At the time of invention of the '676 patent, a national regulation authority determined on what frequencies, with what transmission power and in accordance with what radio interface standard a radio system was allowed to transmit. '676 patent at 1:12-15. There was provided so-called ISM frequency bands (Industrial Scientific Medical) where radio systems can transmit in the same frequency band in accordance with different radio interface standards. *Id.* at 1:15-18. One example of this is the US radio system IEEE 802.11a and the European ETSI BRAN HiperLAN/2. *Id*. at 1:18-20. The two radio systems transmit in the same frequency bands between 5.5 GHz and 5.875 GHz with approximately the same radio transmission method, but different transmission protocols. *Id*. at 1:20-23. In the event of interference, prior art systems were implemented for active switching to another frequency within the permitted frequency band, for controlling transmission power and for adaptive coding and modulation to reduce interference. *Id*. at 1:23-28. These prior art systems suffered from drawbacks. *Id*. at 1:65-2:10. For example, prior art system and methods did not make optimum use and spreading possible of the radio channels over the stations which transmit in accordance with different standards. *Id*. The guarantee of the service quality necessary for the multimedia applications is impossible in the case of interference caused by their own stations or stations

of outside systems. *Id.* at 2:5-8. In the case of alternating interference, the prior art systems did not work efficiently and occupy a frequency channel even at low transmission rates. *Id.* at 2:8-10.

96.   The inventive solution of the claimed inventions of the '676 patent provides an interface control protocol method that overcomes one or more problems of the prior art and makes efficient use of radio transmission channels. *Id.* at 2:11-22. For example, the invention provides a method that controls alternate use of the common frequency band to provide certain predefined time intervals for the use of the first and second radio interface standard and allocate the frequency band alternately to the first radio interface standard and then to the second radio interface standard in a type of time-division multiplex mode. *Id.* at 2:51-57. According to the claimed invention, a control station controls the access to the common frequency band for stations working in accordance with the first radio interface standard and renders the frequency band available for access by the stations working in accordance with the second radio interface standard if stations working in accordance with the first radio interface standard do not request access to the frequency band. *Id.* at 6:29-36. The common radio channel can then be utilized more effectively particularly when the demand for transmission capacity in accordance with the first and the second radio interface standard varies. *Id.* at 2:58-62.

97.   A person of ordinary skill in the art reading the '676 patent and its claims would understand that the patent's disclosure and claims are drawn to solving a specific, technical problem arising from the evolution of radio communications standards that are designed to operate over the same frequency band. Moreover, a person of ordinary skill in the art would understand that the claimed subject matter of the '676 patent presents advancements in the field of radio communications standards, such as 802.11 ("Wi-Fi"), and, more particularly, alternate control of radio systems of different standards in the same frequency band. Indeed, the time of invention is roughly three years after the 802.11 standard was first released in June of 1997. And, as detailed by the specification, the prior art interference control systems suffered drawbacks such that a new and novel interface-control protocol

method was required. The inventions of the '676 patent do not and cannot apply to human behavior and are indigenous to the then nascent field of alternate control of radio systems of different standards in the same frequency band.

98.   Upon information and belief, Verizon makes, uses, offers for sale, and sells in the United States and imports into the United States a network, base stations, and network controllers (collectively, the "Accused Infringing Devices") that provide shared network access to LTE-LAA and Wi-Fi capable devices over at lease one common frequency band.

99.   Upon information and belief, the Accused Infringing Devices infringe at least claim 1 of the '676 patent in the exemplary manner described below.

100.   The Accused Infringing Devices perform the claimed method. In particular, Verizon's Network, base stations, and network controllers perform an interface control method that provides for alternate use of the 5 GHz frequency band, which is used by a first (Wi-Fi) and second (LTE-LAA) interface standard.

Deployment plans
In August, Verizon lit up LAA with carrier aggregation alongside 4×4 MIMO and 256QAM on its commercial network in Boca Raton, Florida to hit 953Mb/s in a real world demonstration. Device and additional field testing are currently underway, with network deployments set to get underway in earnest during 2018, executives indicated.

Mike Haberman, Verizon's VP of network support, said LAA deployments will be concentrated in high traffic areas. The technology will more likely be implemented on in-building small cells rather than macro cells, he added.

Verizon's work with LAA uses carrier aggregation across four bands: three unlicensed bands at 5GHz and one licensed band. An operator representative previously told *MWL* Verizon is looking ahead to five carrier aggregation to add another band of unlicensed to the mix.

Source: https://www.mobileworldlive.com/featured-content/top-three/verizon-confirms-shift-to-laa-over-lte-u/

Source: https://www.verizonwireless.com/smartphones/samsung-galaxy-s9-plus/#sku=sku2930283

Source: https://www.qualcomm.com/documents/progress-laa-and-its-relationship-lte-u-and-multefire

101.   Verizon's Network, base stations and network controllers operate with products with integrated LTE-LAA and Wi-Fi functionality and can operate using a first interface standard (Wi-Fi) and/or second interface standard (LTE-LAA), such as smartphones, tablets, hotspots and other devices. Verizon's Network includes base stations, network controllers and access points that communicate with these devices and that perform the infringing methods.
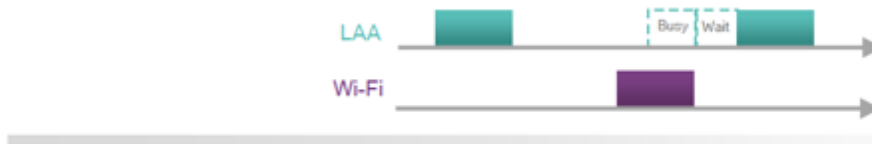
102.   Verizon's Network includes control stations (e.g., LTE-LAA base stations) that control the alternate use of the 5 GHz frequency band.

LAA is designed to protect Wi-Fi
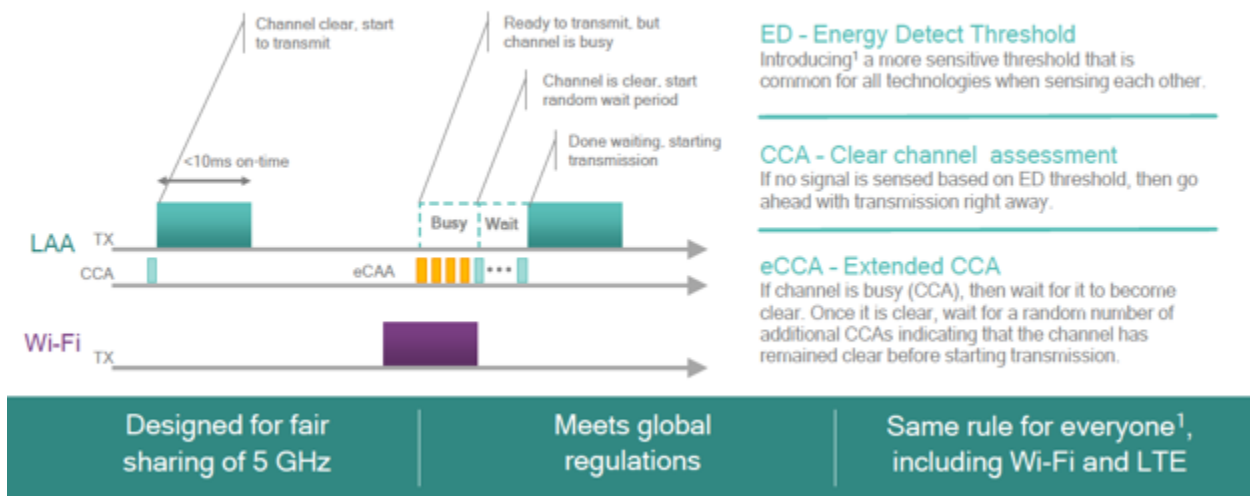
Select clear channel: Dynamically avoid Wi-Fi

Up to 500 MHz available

Sharing the channel fairly: "Listen before talk" (LBT)

LAA

Wi-Fi

Release unlicensed channel at low traffic

LBT ensures fair sharing in unlicensed 5 GHz
LBT is standardized in ETSI EN 301 893

Channel clear, start to transmit

Ready to transmit, but channel is busy

Channel is clear, start random wait period

Done waiting, starting transmission

<10ms on-time

LAA TX

CCA

Wi-Fi TX

ED - Energy Detect Threshold
Introducing[1] a more sensitive threshold that is common for all technologies when sensing each other.

CCA - Clear channel assessment
If no signal is sensed based on ED threshold, then go ahead with transmission right away.

eCCA - Extended CCA
If channel is busy (CCA), then wait for it to become clear. Once it is clear, wait for a random number of additional CCAs indicating that the channel has remained clear before starting transmission.

| Designed for fair sharing of 5 GHz | Meets global regulations | Same rule for everyone[1], including Wi-Fi and LTE |

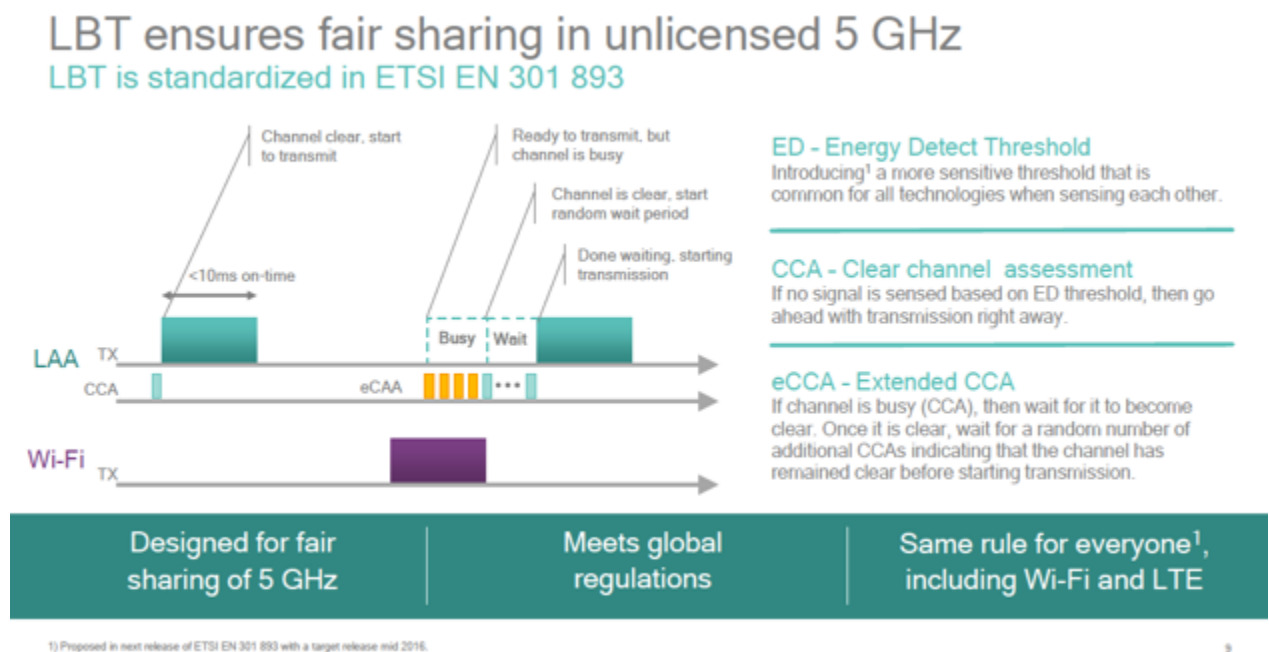1) Proposed in next release of ETSI EN 301 893 with a target release mid 2016.

9

Source: https://www.qualcomm.com/documents/progress-laa-and-its-relationship-lte-u-and-multefire

103.   The Verizon Network LTE-LAA base stations control access to the 5 GHz frequency band, which is used by wireless devices with integrated LTE-LAA and Wi-Fi functionality, such as smartphones, tablets, hotspots and other devices.

104.   The base stations control access to the frequency band for stations (e.g., smartphones,

tablets, hotspots, etc.) working in accordance with the first radio interface standard (e.g., Wi-Fi), for example, by controlling access to the band by other stations (e.g., smartphones, tablets, hotspots, etc.) that are communicating via the second radio interface standard (e.g., LTE-LAA). The base stations render the frequency band available for access by the stations working in accordance with the second radio interface standard (LTE-LAA) when stations working in accordance with the first radio interface standard (Wi-Fi) do not request access to the frequency band. The Verizon base stations accomplish this alternate use via a "listen before talk" method.

Source: https://www.qualcomm.com/documents/progress-laa-and-its-relationship-lte-u-and-multefire

3.4. Proposed Coexistence and Coordination Techniques

3.4.1. LTE LAA Approach

Towards a coexistence technique that respects the regional regulations, 3GPP announced the LTE LAA standards in Release 13, including the description of a Listen Before Talk (LBT) procedure (also known as CCA) [15]. Initially, LTE LAA is scheduled to operate within the 5-GHz unlicensed spectrum and for DL traffic only, but in a later phase, it is expected to be extended to the 2.4-GHz unlicensed band, as well as for both DL and UL traffic. Initially, an eNB will be able to activate and deactivate a secondary cell operating in the unlicensed spectrum. Through this cell, only data traffic (via the PDSCH) can be sent, while the LTE control signals and the UL traffic (PUSCH) will be transmitted via the licensed anchor. The eNB must perform the LBT procedure and sense the channel

prior to a transmission in the unlicensed spectrum. When the channel is sensed as busy, the eNB must defer its transmission by performing an exponential backoff. If the channel is sensed to be idle, it performs a transmission burst with a duration from 2–10 ms, depending on the channel access priority class. The authors in [16] analytically describe the LTE LAA procedure. They provide an overview of the LAA mechanism including the motivation and use cases where it can be applied. Additionally, they present a coexistence evaluation methodology and results, which have been contributed by 3GPP. Figure 5 shows the LTE LAA and Wi-Fi coexistence in the same channel in the unlicensed spectrum.
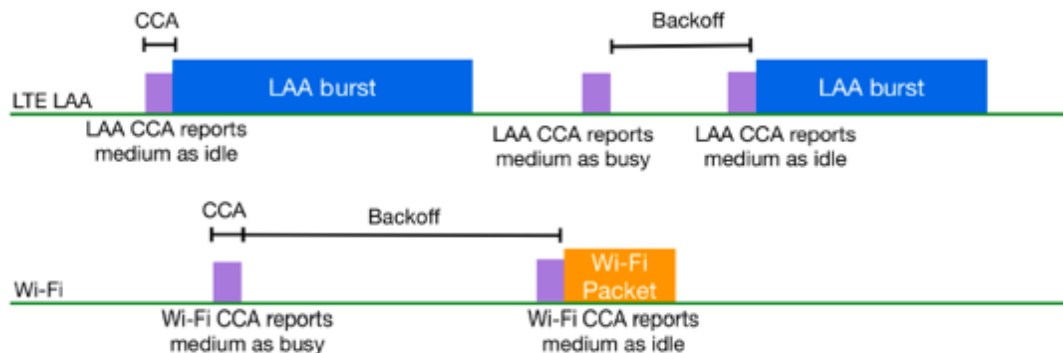

Figure 5. LTE Licensed-Assisted Access (LAA) and Wi-Fi coexistence.

Source: V. Maglogiannis, et al, Cooperation Techniques between LTE in Unlicensed Spectrum and Wi-Fi towards Fair Spectral Efficiancy, www.mdpi.com/sensors (2017)

105.   Verizon has infringed, and continues to infringe, at least claim 1 of the '676 patent in the United States, by making, using, offering for sale, selling and/or importing the Accused Infringing Devices in violation of 35 U.S.C. § 271(a).

106.   Verizon also has infringed, and continues to infringe, at least claim 1 of the '676 patent by actively inducing others to use the Accused Infringing Devices. Verizon's users, customers, agents or

other third parties use wireless devices (e.g., smartphones, tablets, hotspots, etc.) with the Accused

Infringing Devices in accordance with the Verizon's instructions infringe claim 1 of the '676 patent, in

violation of 35 U.S.C. § 271(a). Verizon intentionally instructs its customers to cause infringement

through support information, demonstrations, brochures and user guides, such as those located at:

www.verizonwireless.com; https://www.verizonwireless.com/support/. Verizon is thereby liable for

infringement of the '676 patent under 35 U.S.C. § 271(b).

107.   Verizon also has infringed, and continues to infringe, at least claim 1 of the '676 patent by

offering to commercially distribute, commercially distributing, or operating the Accused Infringing

Devices which are used in practicing the processes, or using the systems, of the '676 patent, and

constitute a material part of the invention. Verizon knows portions of the Accused Infringing Devices to

be especially made or especially adapted for use in infringement of the '676 patent, not a staple article,

and not a commodity of commerce suitable for substantial noninfringing use. Verizon is thereby liable

for infringement of the '676 Patent under 35 U.S.C. § 271(c).

108.   Verizon is on notice of infringement of the '676 patent by no later than the filing and

service of this Complaint. By the time of trial, Verizon will have known and intended (since receiving

such notice) that its continued actions would actively induce and contribute to the infringement of at least

claim 1 of the '676 patent

109.   Upon information and belief, Verizon may have infringed and continues to infringe the

'676 patent through other network technology utilizing the same or reasonably similar functionality,

including other versions of the Accused Infringing Devices.

110.   Verizon's acts of direct and indirect infringement have caused and continue to cause

damage to Uniloc and Uniloc is entitled to recover damages sustained as a result of Verizon's wrongful

acts in an amount subject to proof at trial.

PRAYER FOR RELIEF

WHEREFORE, plaintiffs Uniloc 2017 LLC and Uniloc Licensing USA LLC respectfully pray that the Court enter judgment in their favor and against Verizon as follows:

a.   A judgment that Verizon has infringed one or more claims of the '917 patent literally and/or under the doctrine of equivalents directly and/or indirectly by inducing infringement and/or by contributory infringement;

b.   A judgment that Verizon has infringed one or more claims of the '891 patent literally and/or under the doctrine of equivalents directly and/or indirectly by inducing infringement and/or by contributory infringement;

c.   A judgment that Verizon has infringed one or more claims of the '005 patent literally and/or under the doctrine of equivalents directly and/or indirectly by inducing infringement and/or by contributory infringement;

d.   A judgment that Verizon has infringed one or more claims of the '676 patent literally and/or under the doctrine of equivalents directly and/or indirectly by inducing infringement and/or by contributory infringement;

e.   That for each Asserted Patent this Court judges infringed by Verizon this Court award Uniloc its damages pursuant to 35 U.S.C. § 284 and any royalties determined to be appropriate;

f.   That this be determined to be an exceptional case under 35 U.S.C. § 285 and that Uniloc be awarded enhanced damages up to treble damages for willful infringement as provided by 35 U.S.C. § 284;

g.   That this Court award Uniloc prejudgment and post-judgment interest on its damages;

h.   That Uniloc be granted its reasonable attorneys' fees in this action;

i.   That this Court award Uniloc its costs; and

j. That this Court award Uniloc such other and further relief as the Court deems

proper.

<u>DEMAND FOR JURY TRIAL</u>

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, Uniloc demands a trial by jury for

all issues so triable.

Date: August 29, 2018 /s/ M. Elizabeth Day
M. Elizabeth Day

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